THE JOURNAL OF ENGINEERING EDUCATION

Published by THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

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VOL. XXVI., NO. 2 | OCTOBER, 1935 | Subscription Price $3.00 per year
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Published September 10th!

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Published by the Society for the Promotion of Engineering Education

Published under the Supervision of the Publication Committee.
C. C. Williams, W. E. Wickenden, F. L. Bishop, Editor, University of Pittsburgh.
Published at Prince and Lemon Sts., Lancaster, Pa.

Entered as second-class matter at the Post Office at Lancaster, Pa., under the Act of March 3, 1870.

New Series
Vol. XXVI, No. 2. OCTOBER, 1935 Subscription Price, $3.00 per year. Single Copies, 50 cents

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SHALL WE PLOW UNDER THE "ENGINEERS"?

By P. H. DAGGETT

Vice President of the Society; Dean, College of Engineering, Rutgers University

The principle of engineering registration is now an accomplished fact in all but thirteen of the states. Beginning over a quarter of a century ago with the adoption of a registration law in Wyoming, there was a sudden spurt just after the world war when over a period of four years one half of the registration laws now in force were enacted. Seven more were added during the past six months and further additions are likely within another twelvemonth.

The constitutional basis for these registration laws lies in the police powers of the states to promote the public welfare by safeguarding life, health, and property. Therein, and therein alone, lies the constitutional warrant for these acts. In the states in which comprehensive registration laws are in force, to practice or to *offer to practice* engineering without being legally registered is a misdemeanor punishable by fine or imprisonment. In one of the states an offer to practice is defined as a verbal claim, sign, advertisement, letterhead, card or *in any other way* representing oneself to be an engineer. Thus is the way opened for the use of registration as a protection of the title.

The extent to which this power over the use of the title is already being exercised was pointed out at the summer convention of the A. I. E. E., in a significant address by D. B. Steinman which appears in the August number of *Electrical Engineering*. That the exercise of this legal power will be extended in the future is as certain as anything can be, and a careful reading of the registration laws will convince the most skeptical that there are real teeth in most of these laws.

But the movement has further possibilities of major interest to the engineering colleges. There is a growing sentiment in certain quarters, to which public expression has recently been given, that the engineering profession "will have to take steps, as has the medical profession, to limit entrants (to engineering schools) to the number the profession can reasonably absorb." Just how this is to be done is not clear, but the urge is there and however ill-advised and unnecessary it may be it will probably have to be reckoned with sooner or later.

Engineering has long since ceased to be a matter of private practice by the individual, a fact which makes comparison with the professional status and needs of the lawyer and physician difficult if not irrelevant. That the medical profession has been enhanced by a reduction in the number of medical schools, and the restriction of enrolment therein does not necessarily argue that the same medicine will be good for the engineering profession. And it would be a super-planner extraordinary who could predict with any degree of certainty the number of recruits which the profession is capable of absorbing at any given period of time.

In the States which now have registration for engineers probably less than twenty per cent of the individuals who designated themselves as engineers in the 1930 Census hold valid registration certificates today. If the engineering profession is to be limited strictly to those whose work is of such a nature as to demand public licensing as a safeguard to life, health and property then what shall we do with the other eighty per cent? If the restrictionists win the day then there will be nothing left for these "engineers," there will be nothing left for the thousands of the younger generation whose entrance into a career may best be made through the medium of an engineering training, but to be "plowed under."

THE ENGINEER IN AMERICAN LIFE

By RAYMOND WALTERS

President, University of Cincinnati

The profession of engineering has made an important contribution to American civilization. To substantiate this tribute I could readily specify achievements ranging geographically from the Atlantic lighthouses to the Golden Gate Bridge and from the Great Lake cities to the Galveston sea wall—works in which engineering has made innumerable applications of science to the life of the American people, to their activities on land, water and air, to their health, safety and comfort. Moreover, many of these works possess the ancient Greek virtue of beauty bound up with utility. And in the production of these works, engineers have attained a record marked by efficiency, by professional integrity, and by personal honesty.

A considerable measure of this record has been due to the old American traditions of engineering, with their emphasis upon thoroughness, honest dealing and rigor. To these have been added the spirit and the method of modern science which the engineering profession has absorbed and made its own.

It has been the engineers who have applied the findings of abstract science in marvellous ways in transforming the modern material world.

You may recall that, some seventy years ago, at the dedication of a scientific institution in England, Thomas Henry Huxley commented upon the worship which the practical men of that day, the leaders of industry and business, had for "rule of thumb" and their contempt for science as "speculative rubbish" having no real relationship with every-day life. In both England and the United States there are very few vestiges left of that attitude. I believe it is the engineering profession that has largely changed this old point of view. It has been the engineers who, as public servants, have demonstrated, paraphrasing and modifying the words Huxley used, that science is not speculative rubbish; that theory and practice have a vital relationship; that the scientific habit of mind is not an impediment but very definitely an aid in the conduct of ordinary affairs.

This has come to pass, I think, because, in American schools and colleges of engineering, our teachers have had an understand-

ing and grasp of what scientific research means. They are themselves often engaged in research work, as far as their time and resources permit. They are showing the spirit which makes engineering a true profession. · Specific evidences of these statements are abundantly supplied in the reports of the Committee on Graduate Study and the Committee on Engineering Research as presented today by Professor Hammond and Professor Blalock. For the development of this professional spirit which permeates the various branches of engineering, I believe great credit is due the "founder societies" and other national professional societies, and I am convinced also that a fine contribution has been made by the Society for the Promotion of Engineering Education.

So much for the past and the present. What about the future? To this question answers are being given by speakers on this program upon the general theme "Looking Ahead." We are hearing proposals regarding undergraduate engineering education, graduate study, and research as an instrumentality in engineering education. Tomorrow there will be discussion as to professional status, the employment of graduates, and other topics.

My own thought about the future of engineering is optimistic. I believe it is destined to be a greater profession than ever.

As to the immediate future there appears to be a turn upward in the employment of engineers. We shall hear reports on this at the session tomorrow morning. The prospect seems favorable for a good attendance in engineering schools next fall, particularly since President Roosevelt's announcement today of continuance of Federal Emergency Relief funds for student employment.

Numbers, however, are no criterion as to the true prosperity of the engineering profession or any other profession. Of that I feel convinced after a study made by the Committee on Standards of the American Council on Education, of which President Wickenden is a member and of which I have the honor to be chairman. In our study we considered the professions of law; medicine, college and university teaching, and engineering. We dealt with a question now being raised in each of these fields, should the number of professional students be restricted?

As to numbers our report showed that there were in 1930 some 282,000 men engaged as technical engineers. This represented an increase over 1920 of about 50 per cent, as compared with an increase of 16 per cent in the population for that decade. The per capita proportion in 1930 was approximately one engineer for 425 persons; and, of those enrolled in the professional societies, approximately one engineer for 850 persons.

I shall not weary you with statistics, but shall give you simply a compendium of what are important comparisons:

For each 100,000 population for the country in 1930 there were 116 physicians, 131 lawyers, and 231 engineers. Stated in another way, there was one physician for every 852 persons, one lawyer for every 762 persons, and one engineer for every 425 persons.

We need not be overwhelmed by this comparison. There may, indeed, be a fallacy in the comparison itself, inasmuch as engineers do not perform individual service for the population as do lawyers and physicians.

You will remember that, in his presidential address before this Society on Monday, Dean Williams analyzed statistics of professional growth with the conclusion that, in view of the enlargement of usable scientific knowledge, "we may expect a 68 per cent increase in the annual demand for engineers in the first years of normal operations."

Varied views, some favoring, some opposing reduction in the number of professional students were quoted in the report of our Committee on Standards.

There are persons who maintain that the whole problem of the professions should be dealt with by governmental action, by broad social planning. Whatever our opinions may be, it is manifest that, at the present time, no federal or state action is likely. (My own opinion, may I say, is emphatically opposed to any such national occupational council as has been proposed by one school of educational economists.)

There are persons who favor judgment by the profession, through its official organizations and commissions. Their doctrine has been challenged by an economist who asserts that "the history of groups that have had the power to determine their numbers offers conclusive evidence that that power will be misused." Whether the present advocates of control by the professions can work out an effective program without detriment to the public good remains to be seen.

I shall now venture my own thought about the limitation of numbers, representing not the findings of our Committee on Standards but simply the personal view of its chairman. My opinion is based on two assumptions:

The first is that, in our American democracy today, we should accept as basic the old Benthamite doctrine of the greatest good to the greatest number. We should have in mind less the advantage of the profession and of those in it than the advantage of all the people.

A second assumption is that the good of the people is so peculiarly dependent on the service of the professions that satisfactory conditions within the professions are a matter of public concern. The social welfare of all citizens and the personal welfare of each

citizen are bound up with how the lawyer represents us; how the physician averts disease and, when we have it, heals us; how the engineer builds the bridge over which we ride.

With these two assumptions in mind I propose a new approach to the question of limiting numbers in the professions, including engineering—the approach which emphasizes quality rather than quantity. By quality in the engineer I refer to expertness, personality and character. Apply these criteria and there will be no flooding of the engineering field. The students who do qualify on this three-fold basis will be rightfully admitted to the engineering profession and they will in all likelihood be successful and contented and will receive commensurate rewards. Most important of all, in accordance with our democratic principle, the American people will be well served.

A few words to define what I mean regarding qualifications.

Expertness.—Since engineering has various divisions and fields, standards of expertness may possibly be determined for each and the aptitude of the individual may be measured accordingly. This might be done for the three classifications of functions in engineering outlined yesterday by Professor Doherty of Yale. Expertness represents a combination of native ability, training, and experience. Of such a combination there is no oversupply.

Character.—The best I can suggest here is to paraphrase the definition which William James once gave of an English gentleman. It would then be as follows: "An engineer of character is a bundle of specifically qualified reactions, a creature who for all the emergencies of life has his line of behavior marked out for him in advance." The kind of behavior which the engineering profession expects of him I have already indicated.

Personality.—Personality is the sense of vitality which a man gives us, the feeling that he meets life not passively but actively. The lack of personality has probably caused more failures among engineers in dealing with the public than lack of expertness. Even in research work, Dr. Thomas Spooner found that 84 per cent of the deficiencies analyzed were due, not primarily to lack of technical ability, but to temperamental and personality weaknesses.

The questions immediately arise in your minds. Can we teach character and personality? Can we measure them?

As an old teacher, I myself have a great skepticism concerning character-training courses. Books on personality I consider nonsense and worse, with their so-called methods of selling oneself, "putting across" one's personality. Our first obligation is, I think, to fill our students with scorn for these cheap devices for a glittering and sham success. It has always seemed to me that Woodrow Wilson was eternally right when he said, while President

of Princeton University, that "Character is a by-product. It comes as a consequence of a life devoted to the nearest duty, and the place in which character would be cultivated, if it be a place of study, is a place where study is the object and character is the result."

I believe we can teach character and personality to the extent that we arouse in the minds and the hearts of our students contempt for shabby work and a devotion and an enthusiasm for sound work. This type of indoctrination is not only justified but essential in a confused world in which all sorts of twisted thinking and queer doctrines beset our youth.

Now we must not exaggerate or make Polyanna claims. We can nevertheless assure our students that sound work done faithfully and persistently will gradually build within them the finest character and personality of which individually they are capable. We should frankly say that, in St. Paul's phrase, there are "gifts differing." But we can also assure them that some of the greatest and noblest work in this world has been done by men of no superlative mental gifts but possessing the powers of character and personality which they built within themselves by devotion to some great cause.

Can we measure character and personality? Certainly not on any rating scale which has yet been devised (or I think ever will be devised). But apart from attempts at precise measurement there is a sensible and essential basis for estimating the integrity, the reliability, the inner vitality of an individual. That basis is simply the observation by fair-minded persons who have watched his work as to how faithfully and enthusiastically the individual does his work and, of course, on the side of expertness, how well he succeeds in it.

If it be granted that expertness, high character and vital personality are essential requirements of the engineer, the question arises as to who shall measure these qualifications and how.

There are already agencies in the professions which pass upon qualifications of mature individuals. Approval is indicated by admission to membership in the American Bar Association; in the American Medical Association (with other national organizations of specialists); and in the national societies in branches of engineering as well as the Society for the Promotion of Engineering Education.

These are excellent agencies and it is to the advantage of the nation, in my opinion, that they should flourish. However, as I see it, the broad problem of qualifications for engineering must be met earlier than the professional societies can act. Earlier selection is essential, both for the good of the engineering profession and in justice also to the masses of young candidates who are really not

fitted for engineering and who should not be encouraged to waste money, energy and time in futile preparation for it.

I suggest that the engineering school is in a position to serve as an early selective agency as well as an educational institution, that it is qualified to judge and sift candidates for the profession. Good engineering schools have been doing precisely this for many years. My point is simply that the selective function should be emphasized and strengthened. To strengthen will require that deans and faculties improve procedures of admission, advancement and graduation, utilizing whatever devices have proved worthy. To strengthen will require appraising the character and personality of students; no task facing a dean and faculty calls for more care, wisdom and humility.

I would summarize my thought as follows:

1. If we should conclude (we may not, but if we should conclude) that the increase in the number of engineers has recently been disproportionate to population increase, the solution does not lie in a quantitative but rather in a qualitative approach. Exact high standards and the oversupply will cease. A qualitative basis will be to the advantage of the nation and of the profession.

2. Later criteria, such as professional society membership, are valuable but an earlier selection from the mass of candidates is fairer to them and better for the profession. The engineering school may effectively serve as such a selective agency.

3. In its selective function the engineering school has a difficult task but one of great importance. Each school should hail quality as its obligation and goal as never before.

A few words, in closing, in regard to the future of engineering. As I said earlier, I am optimistic about the profession as I am about our economic and social order in the United States. You are familiar, of course, with the assertion that technological changes due to scientific inventions will be such as perpetually to force millions to remain idle. You are probably familiar also, but it is so fundamental as to bear repetition, with the answer of Professor Millikan of the California Institute of Technology, when he pointed out that the proportion of our American population gainfully employed rose from 34 per cent in 1880 to 40 per cent in 1930, an increase in the very half century in which scientific inventions were sweeping away older industrial techniques. No flight of imagination but merely a sense of history leads us to predict many opportunities for youth in the future, perhaps as different from those of the present as the automobile and the radio are from the Conestoga wagon and the first Morse telegraph.

Dean Williams, in his presidential address asked, will the "current of progress slacken or diminish when there is no exhaustion

of nature's resources, when the needs of men are unlimited in variety, and when the usable scientific knowledge is ever increasing?"

His answer that he thinks not is reinforced by the recent work of President Charles F. Kettering of the General Motors Research Corporation.

There seems to me to be sound sense in the declaration of President Kettering: "The world isn't finished. We have only begun to make it a better place to live in."

What of the engineer in this approaching era? If, to professional expertness, he adds the character and personality which the world demands of its leaders, the engineer will increasingly perform a great service for our country. More than ever he will, in addition to technical positions, serve as administrator in industry and in business, and in the new fields of public service. He will, in manifold ways, contribute to the stability, the beauty and the dignity of human life.

COMMITTEE ON OBJECTIVES AND LENGTH OF CURRICULUM

MAJORITY REPORT

The number of years required for an education in engineering is too complex a matter to be settled simply by a "yes" and "no" vote on a single proposal. The length of a curriculum properly depends upon its objective, and there are different objectives to be reckoned with. Moreover, there are important practical factors which bear upon the question. For illustration, (1) under the existing industrial régime engineering graduates, unlike those in other professions such as law and medicine, have a choice as to whether they will end their formal education after four years and take a job, or continue longer on the prospect of a better ultimate return; (2) there are indefinite gradations in the nature of work which an engineering graduate may enter from highly technical activity on the one hand, to business on the other; (3) some of the larger industries provide opportunities for further formal study; (4) study at college is expensive, and the duration of active professional life is limited; and (5) the prediction of ability and aptitude is still in an undeveloped stage. These are all matters which must be taken into account in any rational plan that will serve present needs and at the same time tend to guide future developments into constructive channels. Thus the lines of the Committee's study have not come to focus upon a single time-span of formal training applicable alike to all phases of education associated with engineering; rather, they have indicated the desirability of different spans—some less, some more, than four years—and of a reasonable flexibility in institutional choice regarding these. In other words, the Committee feels that the profession has not yet reached a stage of development at which it can wisely set up, even as an ideal, a complete and fixed single pattern according to which the duration of formal study at college should be set.

However, this is not to say that we should have no pattern at all. Certain aspects of the matter do seem clear and the most should be made of these in an effort to establish at least the most general forms of patterns that now seem desirable. Then by further experience, study, and planning, these may become more definite and perhaps finally integrated into a master educational pattern. The Committee accordingly concludes that the Society may

well take preliminary action at this time. It can (1) undertake to establish a more definite and unified conception of the broader objectives of educational programs; (2) suggest certain corresponding tentative time-spans of formal study at college which seem reasonable from the point of view of the present; and (3) encourage experimentation with certain supplementary educational provisions which might have a direct favorable bearing upon the problem. The hope would be that out of the consequent developments during the next decade a rational and more adequate answer to the length-of-curriculum question might gradually emerge.

In its review of educational objectives to the extent that these relate to the length of curriculum, the Committee naturally turned to the S. P. E. E. Report (1923–29) to various individual studies published since, to opinions from a number of engineering educators, and to the character of actual engineering service as it now appears. As already indicated, one does not find in all of this a very clear way out so far as the length-of-curriculum question, as an isolated matter, is concerned; yet one does find a reasonably uniform direction of thought regarding objectives, with respect to which the curriculum question may possibly be resolved.

Recommendations

The Committee recommends the adoption of the following:

There are three general *types* of function associated with engineering service, and all of them are essential to a balanced profession. These are represented by

(*A*) the technician who performs the routine tasks associated with engineering work;

(*B*) the engineering practitioner and the supervisor who *carry on* the usual engineering and industrial operations;

(*C*) the creative intellectual leader in the higher levels of engineering service either on the scientific side, in industrial administration, or in public service.

These three classifications do not refer to students or even necessarily to individual engineers, but to types of function associated with engineering practice; not to college, but to the profession. Moreover, they include all phases of activity associated with engineering. For brief illustration,

(1) *In purely technical service,*

Classification *A*: the routine draftsman and calculator,
B: the usual designer and application engineer,
C: the creative engineer and analyst;

(2) *In administration,*

Classification *A*: the sub-foreman or supervisor of routine operations,

B: the supervisor of construction and the factory foreman,

C: the factory or sales manager and chief engineer;

(3) *In sales,*

Classification *A*: the sales clerk,

B: the salesman of standard apparatus for usual applications,

C: the creative sales-engineer who can discover new and profitable possibilities for his customer and get the business.

The first classification (*A*) is already recognized by the Society (S. P. E. E. Report, p. 110). The other two, (*B*) and (*C*), are still largely lumped together. Hence the above division into three classifications instead of two would merely carry out the next obvious step in clarifying the major phases of function associated with engineering, and their implications in educational procedure.

Educational Preparation

Appropriate educational preparation for each of the three types of service is sufficiently different to justify, if not require, three corresponding types of programs as indicated below.

For Classification A

For this, the technical institute plan has already been adopted by the Society, but only partially carried out. The Committee indorses this plan which would involve a program of preferably two years after high school.

For Classification B

Characteristic type of function: To carry on under precedent or general direction. For illustration, this involves the exercise of judgment within the limits of precedent, and the ability to solve problems of established types, in connection with technical, supervisory, or sales activity associated with the usual engineering enterprises.

Objectives of educational program: The training should be tested by the graduating student's ability to understand and solve problems, including those involving economic considerations, which have been defined for him in rather specific terms, or which are

solvable by precedent—that is, by the application of the special principles, formulae, rules, or techniques of the particular field; by his ability intelligently to carry out tests or studies of a more or less standardized type, and to prepare reports which are clear, orderly, and accurate; and by his ability otherwise to use the English language effectively. All of this implies very little emphasis upon autonomous work, but the necessity of a reasonable grasp of the basic science underlying the techniques and methods he has learned to apply, and considerable drill in such applications.

Length of program: Four years at college should be regarded as a norm for this service.

It should be recognized, however, that there may be good reasons for variations from this. From the practical considerations already mentioned a qualified student in any institution may himself wish to cover either a broader ground at undergraduate level, or advanced work at graduate level. Or, an institution may feel that its policy should be to cover a greater range of undergraduate work than it finds to be possible in four years. Either case should be in order. Whatever the future may bring, the Society, under the existing practical situation, is not in a qualified position, either by decisive evidence or control, to place restriction on variations from what may now seem to be a reasonable norm.

For Classification C

Characteristic type of function: Intellectual leadership which *creates new lines of thought and activity.* This involves, for illustration, the analysis, formulation, and solution of complex problems of technical, economic, or social nature; invention; the framing of policy; the direction of important engineering and industrial enterprises.

Objectives of educational program: The training for entering professional service leading to this classification should be tested by the student's grasp of the basic science and other fundamental knowledge underlying his field, and by the extent and character of his knowledge of the social and economic aspects of engineering activity; by his capacity to draw rational inferences from given data, to devise, and create; and by his ability to express his thoughts logically and with a scholarly style. All of this implies a large measure of autonomous work, and disciplines designed especially to cultivate analytical and creative powers, an historical perspective, and clear, logical expression.

Length of program: The optimum length of program for this classification is even less definite than that for *B*. Unquestionably it should be longer, but neither the total time nor its distribution

between undergraduate and graduate work is indicated as a definite matter. Each is variable with respect to individual ability and the field of preparation. The more capable the student, the longer the total period should be; and, at least under the existing industrial régime, the highly technical field requires longer formal preparation than does the quasi-engineering activity in the realm of business. Moreover, the technical field requires a greater portion of work at graduate level than the other. Thus if engineering education is to continue to embrace preparation for professional service in any band of the industrial spectrum from engineering science to management, as it undoubtedly should, then only the most general form of recommendation can be made as to the length of curriculum. It should be a minimum of four years with appropriate variations in the extent and nature of the desirable, if not essential, additional work, these depending upon the individual ability of the student, the field of preparation, and the special facilities and staff of the institution.

Selection of Students

The whole plan contemplated in this report is predicated upon a reasonably effective selection of students for the different programs; hence it is extremely important that this factor be critically examined from all angles.

In the first place, let us understand precisely what is involved in the selection contemplated here. The necessity of predicting the student's future performance is certainly involved; but performance in what? Not in professional activity, but in a specified college course. Prediction of success in a specified type of professional work and in a particular college course are two different things. Few informed people profess the ability to do the former because tests of aptitude and ability are not sufficiently developed; but most of us feel at least a degree of confidence in estimates of performance in a future portion of a college program, based upon actual performance in a past portion. Such estimates are constantly being made and, apart from a few very noteworthy exceptions, confirmed by experience. And this is the only selection problem involved in the proposed plan.

Now whether the particular course to be pursued is appropriate to its objective is quite another matter. This question was settled when the general educational policy was settled—that is, when the educational objectives were framed with respect to the different types of professional function. Professional success is not assured by the successful completion of any particular curriculum. We have not in the past, and logically cannot in the future, gage the practicability of a proposed program on the sole criterion of pre-

dictability of consequent professional success. Thus to repeat, once the educational programs are settled upon, then the problem of intelligent selection and guidance of students is little different from that now commonly dealt with.

The only difference is that which might arise from a possible difference in basic educational procedures adopted in the two cases. If, for instance, in the *C* program greater emphasis than in the past were placed upon independent work of a project nature, as would seem likely, then past success in the usual class procedures of the first years might not be as valid an indication of performance in the last year or so as it has been. However, a student fitted naturally for a *B* program would not be lost if he entered upon a *C* program. He might be under somewhat more stress, but assuming he could carry the work, he would probably profit by the experience. Certainly he would not be harmed. The *C* program obviously must involve sufficient ground work in technical and other aspects which characterize the *B* program to make it possible for the *C* graduate to get a job and work his way, as he must, through *B* activity.

But even such cases of inappropriate choice should be reduced by a planned flexibility. All along the line the next step ahead in course should be determined by the student's inclinations and accomplishments at the time, even during the senior year. The whole plan thus should be characterized by a *reasonable flexibility* as to selection, but by *rigidity* as to the educational objectives of the programs.

Supplementary Educational Provisions

There are other ways of covering educational ground than formal courses in college, and the possibilities of these should be further explored than they have been. One is purposeful summer reading. Further study in certain non-technical subjects such as economics, sociology, English, and history, might be carried out during free time in the summer and examinations taken in the fall for credit required for the degree. The non-technical content of present engineering curricula might thus be enlarged and enriched, and some of the objects of proposed longer curricula be attained.

Another is post-college study. This also would tend to reduce the required time in college. But some element of compulsion would have to be present to assure that the work be covered. Since it would probably not be practicable to withhold the degree pending the completion of such work, some other form of compulsion would have to be found. Possibly the completion of such work might be made a requirement for professional certification.

The Committee feels that where local conditions may seem favorable experimentation along both lines should be encouraged in order to determine definitely to what extent such plans may hold promise.

Possibility of a Two-Year Terminal Program

Since the technical institute plan has not yet been reasonably developed so far as concerns the number of institutions offering such a program, it is recommended that a committee be appointed to study the possibility of establishing programs with a terminal at the end of two years, at institutions already providing four-year courses.

V. M. Faires,
H. C. Sadler,
D. B. Prentice,
R. P. Baker,
R. E. Doherty, *Chairman*

MINORITY REPORT

For many years, American engineering schools have turned out engineers who have proved to be as well trained technically as any in the world. Some of them have dropped back to what the report calls the *"A"* function, the majority have probably carried out the *"B"* function, but many of them have become creative intellectual leaders in the higher levels of engineering service, in industrial administration, or in public service, which is the *"C"* function as classified in the report. They have been equally successful in technical service, in administration, and in sales service, and no special training appeared to be a pre-requisite to success in any of these lines.

While I am strongly inclined to believe that trade schools that are intended to train nothing but mechanics or technicians would be a fine thing and that a not inconsiderable portion of young men who now enter engineering schools should enter such trade schools, there appears to me to be no necessity for planning curricula especially for engineering practitioners and for creative leaders.

The trouble with the engineering curriculum of approximately 145 semester units that prevails generally in American engineering schools is not that it does not make good engineers and creative leaders, but that it is not broad enough to fit most of its graduates to become high class professional men in every way comparable with first-class lawyers, doctors, and the followers of other highly regarded professions.

The average engineering student (who is far above the average of all college students in mentality) who tries to complete such a course in four years cannot study enough history, literature, languages, etc. to give him the cultural background that every professional man should possess. He finds it very difficult to engage in athletics or highly desirable extra-curricular activities like debating and dramatics. It is not fair or right to our engineering students that we should deprive them of these advantages and opportunities. Engineering should be placed on the same professional basis as law or medicine.

By lengthening the curriculum to at least five years, requiring about 175 semester units for graduation, thirty units of the humanities can be added to the curriculum without dropping any of the technical work now required, and an engineer will have some time for desirable extra-curricular activities. A Bachelor of Science degree might be granted after four years with the explicit understanding that the holder of such a degree could not consider himself or claim to be a college-trained engineer, and the professional degree might be granted after five years, dropping its use as a recognition of achievements after graduation.

This plan is simple and easy to apply. It meets the needs of the engineering student in a very satisfactory fashion. It eliminates the criticisms that are now directed at the one-sided training that engineers receive. It can only be put into effect satisfactorily, however, if the majority of the engineering schools in the country will adopt it and agree to put it into operation at the same time.

With due respect for the very capable gentlemen who have prepared the report, I claim that that report is indefinite and inconclusive and has not answered the question which I understood our committee was created to consider. That question was: "Should or should not the four-year engineering curriculum be lengthened?" My vote is "Yes."

G. M. Butler

REPORT OF COMMITTEE ON ORIENTATION OF FRESHMEN

It was decided that the work of the Committee for this year should be a survey of the orientation programs of the engineering colleges, the principal feature of which would be an appraisal of the effectiveness of the programs now in operation.

A somewhat similar survey was made in 1927, the report having been presented at the Orono meeting. Replies were then received from 109 schools. Only 50 per cent of these were giving either orientation work or engineering problems.

This year's questionnaire was sent to 122 institutions. Replies were received from 113. Of these 14 reported as having no orientation programs, thus indicating that 88 per cent of the engineering schools of the country are actively engaged with some form of orientation.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

Committee on Orientation of Freshmen

QUESTIONNAIRE

1. Name of Institution .....
2. Name and Title of Individual furnishing the information .....
3. Is your orientation program handled by
   (*a*) A separate organization?
   (*b*) Members of your faculty to whom the work is delegated in addition to their regular duties?
4. If (*a*), describe the character of the organization and how it functions.
5. If (*b*),
   (*a*) Is there a proportional reduction in their regular schedules?
   (*b*) Do they receive extra financial compensation for this work?
6. What is the average size of your Freshman class for the last five years?
7. What is the average size of the sections handled in your orientation program?
8. Please state advantages or disadvantages of this size of section.
9. What are the principal objectives of your program of orientation?
   (Please arrange in the order of the emphasis you place upon each.)
   (*a*)
   (*b*)
   (*c*)
   (*d*)
   (*e*)
   (*f*)

(Continue on back of sheet, if necessary.)

10. To what extent do you make use of Pre-College Guidance as preliminary to, or part of, your program of orientation?

11. To what extent do you use Aptitude Tests and Measurements as preliminary to, or part of, your program of orientation?

12. From your own experience, which of the following general plans do you consider best adapted to the attainment of the objectives which you have listed above, and why?

    1. Orientation Week.
    2. The Counselor System.
    3. Lectures to Freshmen.
    4. Engineering Problems Courses.
    5. Special Study and Conferences Courses as in Dean Williams' book, "Building an Engineering Career."

    (Please describe your own program if it does not fall within this list.)

13. How serious, in your opinion, is the danger of these orientation programs doing *too much* for the student, thereby weakening his power of independent thought and initiative?

    (Use the backs of the sheets for extensions of your answers and for comments which in your opinion may be of assistance to the Committee.)

Questions 3 and 4 ask whether the orientation program is handled by a special group devoting its whole time to the work, or whether it is handled by members of the faculty as a part of their regular duties.

While in the larger institutions it is quite the common practice to have a special administrative officer, such as Dean of Men, Junior Dean or Dean of Freshmen, who is responsible for the program of orientation, in practically all cases the Dean of the College and members of the faculty take care of these programs as a part of their regular duties; this work being considered in the same category as service on committees.

Question 5 asks whether extra compensation is received for this work, and whether there is any reduction in teaching schedules for members of the faculty actively participating therein.

So far as the replies to this question indicate, it is not the custom to allow extra compensation for this service.

Question 6. From data reported by 93 schools the average size of the Freshman class is 202, the figures ranging from 18 in one institution to 650 in another.

Question 7. Where the program consists of lectures the whole class meets together as one section. Where the counselor or adviser system is used, or with engineering problems courses, the sections must necessarily be much smaller, data from the replies indicating that the number of students per section ranges from 5 to 50, with 15 or 20 as the most favored size.

Question 8. The answers to this question, where any were given, indicate that the number of students assigned to a section is most usually determined by limitations of personnel and difficulties of scheduling, and not by considerations of what might be the ideal arrangement. Where orientation programs include inspection trips to industries, visits to the engineering laboratories, and even the performance of simple laboratory tests, the numbers in a section must of necessity be much smaller.

Questions 9 and 12 are the most important ones in the whole questionnaire. They are likewise the most difficult to interpret and to incorporate into a report such as this.

In the letter accompanying the questionnaire this statement was made:

> The committee is of the opinion that the term "Orientation of Freshmen" for the purpose of this questionnaire should include the idea of motivation and be interpreted to mean the proper introduction of the freshman to the college courses in engineering as an initial step toward "building an engineering career."

This may, in a sense, be regarded as the general or comprehensive objective, which should, however, be restated in terms of the more specific objectives which it includes.

Forty-two per cent of the colleges of engineering have as the significant feature of their orientation programs what is generally designated as "Orientation Week," though the actual length of the program varies from one day to ten days. This type of program is, as a rule, not designed specifically for engineering students but is applicable to freshmen in all departments. The principal objectives of orientation week may be said to include the general adjustment of the student to his new environment and new conditions upon first entrance to college. The program is largely informational in character, and serves principally as a means for getting the student acquainted with the geography of the campus, and preparing him for the more or less intricate procedure of registration into the college and the course of his choice. Some of these "orientation week" programs are so filled with lectures, traffic rules, good advice and vocational guidance, compressed into such a short period of time, that there is danger of leading to confusion in the mind of the student, rather than rendering him real assistance.

If any definite conclusion may be drawn from the replies as to the effectiveness of "orientation week" programs it is that such programs are of very doubtful value if they stop short at the end of the allotted period, and are not followed up with more individ-

ualized contacts with the students throughout all or a part of the session.

Taking up those objectives which apply more particularly to the freshman engineering student, the data from the questionnaires indicate that the first in importance is to give the young student a clear and comprehensive idea of what engineering means. Quite closely related to this, but frequently stated as separate objectives are:

To teach the student the engineers' mode of thinking.
To study the history of engineering.
To introduce the student to the vocabulary of engineering.
To direct his attention to the ideals of the profession.

The second objective in the order indicated by the replies to the questionnaire is to assist the student in making a proper choice as to the particular branch of engineering he desires to pursue.

The third objective in point of emphasis is that of assisting the student to adopt efficient methods of study and to form orderly mental habits.

Next in importance comes the objective of conserving the students' initial interest in engineering throughout his first year, when he is very apt to be disappointed at finding nothing in his curriculum which he looks upon as real engineering.

There are many other objectives in the replies from the different institutions, but those noted above apply more particularly to the introduction of the young student to the real meaning of the engineering curriculum and its relation to the engineering profession.

These others have more to do with the proper adjustment of the student to the new social and economic environment he finds in the modern college with its many and varied activities, demanding of him who desires to receive the greatest value from his college course, a carefully adjusted balance between curricular and extra-curricular activities. For this he needs skillful and sympathetic guidance. The point should never be lost sight of that, while we think of our engineering colleges as professional schools, the student in his first two years is quite far removed from that professional attitude which obtains in the schools of Law and Medicine.

Question 10 as well as question No. 11 on Aptitude Tests and Measurements, was incorporated in the questionnaire on account of the attention these matters received at the conference held at the Ithaca meeting and at other previous meetings.

Of the schools which answered this question, 55 per cent stated definitely that they had made no use at all of pre-college guidance. The remaining schools employ it to a limited extent through distribution of literature, visits to high schools and talks to graduating

classes. Only a few engineering schools have developed well organized programs for contacting high school students and furnishing vocational guidance with reference to the study of engineering.

Question 11. Of the schools answering this question, 36 per cent made no use at all of such tests or measurements. The remaining 64 per cent report the employment of such tests for a number of purposes, very few of which appear to have any specific application to *engineering* aptitudes.

Question 12. The programs here listed appear to embrace those that have been most discussed at previous meetings of the Society. The last of these, "Special Study and Conference Courses as in Dean Williams' Book, Building an Engineering Career," was added to the list on account of the interest which this book has created since its appearance last year, and also because the program of orientation set forth therein contains many valuable suggestions.

The somewhat extensive use of "Orientation Week," either as preliminary to a more extended program, or as the whole program, itself, has already been alluded to, 42 per cent of the schools of engineering making use of this plan.

Sixty-one per cent of the colleges use lectures to freshmen in their orientation programs. These lectures are in a few instances compressed into the short period of time assigned to "Orientation Week" and are given by the dean and heads of departments. They deal with the problem of general adjustment to college life as well as with his proper introduction to the engineering curriculum as the first step in the students' engineering career.

In the greater number of cases, however, these lectures are given throughout the first semester or even throughout the whole of the first year.

The Counselor or Adviser System constitutes the principal feature of 40 per cent of the programs; Engineering Problems Courses account for 25 per cent and programs somewhat similar to that in Dean Williams' book are used in about 20 per cent of the schools.

These percentages are overlapping and are not independent of each other, many schools combining several of the systems into one program, beginning for instance with Orientation Week, following this with a course of lectures on engineering topics or with a course in engineering problems, and taking care of the personal problems of the individual student through well organized counselor or adviser systems.

Question 13. The insertion of this question appears to have occasioned a considerable degree of surprise, in spite of the fact that in practically every conference where the subject of orientation has been discussed, "various speakers have pointed out the danger

of counselor and guidance programs doing for the student much that he should do for himself, thus permitting guidance to degenerate into coddling." The last sentence is quoted *verbatim* from the report of this Committee at the Ithaca Meeting. A majority of the schools feel that their programs are so organized and so well conducted that there is very little or no danger of their doing *too much* for the student. One school, in fact, believes there is danger of doing *too little*.

Pertinent Comment

Grouped together under this heading are a number of statements, either quoted or abstracted from the answers to the questionnaire, which indicate the wide range of opinions concerning the various phases of orientation.

Bucknell University. Our classes in engineering are sufficiently small so that the class itself serves as a means of adjusting the student in problems of importance in his work. Close personal contacts are thus possible between the student and the *engineering professor* who assumes an interest in the individual wider than his mere class work.

University of California. I believe there is too much time wasted in discussing orientation and too little time used by inspiring teachers in inculcating into students a spirit of self-reliance.

He who receives an opportunity, gets somewhere when he has the instinct to take advantage of it without too much outside help.

The Cooper Union. As our student body numbers but 350, we are fortunate in having the advantages of close personal contact between the instructor and student; a factor which cannot be too highly evaluated in the alignment of students and in creating in them a professional attitude.

University of North Carolina. As you will see from the answers supplied we have not set up a separate program of orientation. Instead, we are trying to do it as a part of the regular courses of instruction. We are not sure that this is the best method of meeting the need of this type of instruction, and we are studying the matter from year to year.

University of Tennessee. I am plainly sceptical about much of this talk on orientation. If a young man wants to fly, about the only thing I can think of is to let him try it and learn if he has wings. At present we have a course in engineering problems given by a mature man.

University of Texas. I think there is grave danger of these orientation programs doing too much for the student. Have given up orientation except in an informal way.

Villanova College. The writer does not recommend the above program (orientation week). To the serious minded student it is too concentrated with little likelihood of good digestion of the advice offered. To the rest it seems a "bull" session.

Virginia Polytechnic Institute. We use lectures and problems. Also have orientation week, but it has no value as to orienting students into the correct curriculum.

University of Washington. A department of General Engineering has charge of all freshman work including registration, advising and teaching six engineering courses. The courses taught by this department are Drawing and Descriptive Geometry, Engineering Problems based on mathematics and elementary mechanics and Surveying. All instructors in all General Engineering Courses act as advisers. Orientation talks are given in the first quarter of the Problems course. The entire first year is thought of as a part of the orientation program.

We are as a department certain that the problems courses, when properly taught, greatly develop a student's initiative and power of independent thought.

Washington University. Following an orientation period of two days, the continuation of our program is in the hands of a group comprising the Dean, members of the faculty and student members of Tau Beta Pi. Advisers are selected from the active membership of Tau Beta Pi. Prior to the adoption of this plan, the Freshman advisers were selected entirely from the ranks of the faculty. Experience thus far serves to indicate that the contacts between members of the Freshman class and the Tau Beta Pi advisers are more frequent and intimate than was formerly the case.

We have purposely avoided orientation courses which are too paternalistic. We prefer to make it as clear as we can to the Freshmen at the beginning of the year that work of the school is on a professional basis and that the students will be expected to conduct themselves accordingly. The real purpose of spending considerable time with the laggards is to determine as completely as possible whether there is any hope for them, and if so to spur them on to successful performance. If after a reasonable time such efforts are found to be unavailing, the incompetents are removed. The genuinely worthwhile students need very little guidance beyond making it clear to them that they should have interests outside of the immediate courses in which they are registered.

The lecture system was tried over a considerable period of years, beginning about 1917. It was intended to be an orientation course with lectures by members of the faculty and by visiting speakers. The system was dropped a few years ago after it became evident that attendance at these lectures was perfunctory.

We have never experimented here with a course on Engineering Problems. I have always doubted the practicability of such courses because the students do not know enough to solve a real problem and it seems futile to spend time on exercises which they very soon discover to be puerile.

Alabama Polytechnic Institute. In my opinion the average high school student decides what course he is going to take when he decides the college he is going to enter . . . they do not wait until they get to college to decide on the courses in which they will register . . . if they change their minds it is not because of anything that may have been said to them during Freshman Week.

Johns Hopkins University. The course of lectures, designated as General Engineering, has been remarkably successful, I believe, in helping a

certain proportion of our students to find the field in which they are most interested.

University of Arizona. Lectures once a week through the first semester have been found to be thoroughly satisfactory.

University of Iowa. We used lectures to Freshmen for several years, but found them *ineffective.*

University of Michigan. I would rather not call our Freshman Assembly "lectures to Freshmen." If a speaker lectures to the boys he is not likely to be invited back. We do not like the word "lecture." It sounds too much like the word "advice."

University of Minnesota. Our freshmen are required to attend one lecture per week throughout the year, without credit, notes or any other requirement than attendance. It was first designed to assist freshmen in choosing a branch of engineering to follow, but years of statistical studies have shown that *very few* change from their first choice of a course, at the opening of the sophomore year. Thus there is little virtue in a *common freshmen year.*

Northeastern University. Interesting, informative lectures on engineering are given each year by the heads of the professional departments. This is perhaps of less importance than other elements in the program.

State College of Washington. We have felt that Orientation Programs tend to be misleading and might easily do more harm than good through giving false impressions of technical methods.

Princeton University. From our experience we believe that lectures to freshmen and such a book as that of Dean Williams are better adapted to the attainment of our objective than any of the other plans.

Purdue University. We are giving up our Engineering Problems Course and will use Engineering Lectures beginning 1935–36. The new plan will be a combination of lectures and the counselor system.

University of Toledo. I consider the courses as in Dean Williams' book, "Building an Engineering Career" to be best adapted to the attainment of our objectives because the students are more prone to study from the text than to sit and listen to a lecturer speak on an apparently uninteresting topic.

University of Detroit. Counselling and advisement should not take from the student any of his responsibilities; these he must carry himself. Orientation is confined to directing and reasonable encouragement, but particularly to imparting information.

Iowa State College. The Counsellor System, if complete, has the greatest all round potentialities of any of the other systems.

Counselling does not necessarily imply:

1. That the college will try to set up a problem solving agency to which each student may bring any and all of his problems, and receive a solution which removes all obstacles and guarantees clear sailing.
2. That the student will become so dependent upon this consultation service, because it is so readily and freely available, that he will lose his sense of responsibility and resourcefulness and refuse to meet his situations wholly by himself.

The true purpose of counseling is to bring together all of the facts,

to exercise "deliberate judgment" to examine "the consequences" and thus let the student make his decisions and plans.

Men who can satisfy all the requirements for an effective counselor and who are willing to serve in that capacity are not plentiful. Capable and ambitious men are reluctant to assume the responsibilities and the hard work that are connected with counselling, however much they may be interested in such a program, because they fear that recognition and promotion may pass them by. This is a consequence of the emphasis which is given to productive scholarship, meaning research, publications and additional degrees, in determining an instructor's eligibility for promotion.

University of Michigan. We can no longer afford to remain blind to mental, emotional and social maladjustments among our students. A Counselor or Orientation program may be the finest of its kind in all other respects, but if it ignores the real cause of a student's difficulty, it will miserably fail in that case. Several studies have shown that on any campus, or for any group, whether male, female, undergraduate or graduate, in any one year as many as 10 per cent of the students will be in acute need of understanding treatment of professional or near-professional character. Every large school must have a full-time psychiatrist or mental hygienist. Every school of any size should have someone in its counselor system who has read enough in this field to enable him to recognize at least the more usual cases of emotional upset, and to deal understandingly with a good share of them. Preferably, every counselor would have some share in the reading and discussion that can lead to an intelligent attitude on human problems.

University of Illinois. The counselor system soon wears out unless organized and kept in the hands of enthusiastic counsellors. Orientation week is of small value as a vocational guidance program. We believe in vocational information but fear programs that attempt too much in the way of vocational guidance. The student's voluntary choice of a vocation is the vehicle on which any counselling must be carried. An open door to discussion of individual problems by a competent adviser is preferred.

Tufts College. As the numbers in this institution are small we get best results by our adviser system. We have exceptionally valuable men as freshmen advisers. The good results are not the result of the "system" but of the devotion and helpfulness of our Freshman adviser.

University of Akron. I am firmly convinced that we are neglecting a big opportunity in not giving a 3-hour engineering problems course throughout the 1st year.

University of Arkansas. We consider engineering problems courses best suited to more advanced students than freshmen, and have, therefore, placed them in the sophomore and junior curriculum.

University of Delaware. We do not believe in the so-called "Engineering Problems Course." We prefer to solve these problems in their proper order in the different engineering subjects after proper prerequisite training has been given.

University of Oklahoma. Our Engineering Problems courses serves as material in the freshman year to make our freshmen feel that they are really doing some engineering work.

A brief word of comment should be added here concerning the program of orientation as set forth in Dean Williams' "Building an Engineering Career." While very few schools have adopted this program in its entirety, a number are using the book as a text, or for reference in their own systems of orientation.

Conclusions

(The Chairman of the Committee desires to state, in justice to the other members thereof, that conditions beyond his control have made it impossible to refer this report to them and he alone is responsible for the decision as to the matter to be included, for the errors of omission and commission and for the conclusions drawn.)

Any attempt to suggest or propose a standard program of orientation would be foolish; these programs must be and will be just as individual as the institutions themselves, but there are certain fundamental characteristics which may be pointed out.

The young student who desires to study Engineering comes, with few exceptions, directly from the high school or preparatory school into a division of the institution, which we call a professional school, but which to him appears not greatly different from the Arts college, particularly in so far as the scientific courses of the latter are concerned. In his first year he takes English, Mathematics, Chemistry, occasionally a modern language or History, just as does his scientific friend in the Arts college, and he supplements these with a course in Mechanical Drawing, Shop Practice, Elementary Surveying or Engineering Problems. Most of us agree that he needs a reasonable amount of guidance and orientation in his personal problems, in his adjustment to new conditions, in his extra-curricular as well as in his curricular activities. Much that is to be done for him, therefore, is quite the same as for his friend in the Arts college. What we are principally concerned with in this report is his proper introduction to the school and to the engineering curriculum as the beginning of his engineering career. If it is possible to draw a few general conclusions from what has gone before, they might be stated thus:

Orientation defined as above, should not be a "short course."

It should continue actively throughout the whole of the Freshman year.

It should not be too highly formalized; the normally intelligent student will often secure more effective guidance from observation and absorption than from the precepts and lectures of his advisers. The wise and experienced counselor will recognize this fact.

Orientation Week would appear to be of value chiefly as an aid to the sometime intricate procedure of registration, and to other

necessary adjustments of the student to his new environment. If the attempt is made to include a large amount of information in this sort of program and to require the student to attend a great number of lectures, he is very apt to become bored and to revert mentally, if not orally, to that very expressive word "bull."

It appears to be generally conceded that lectures do not constitute an effective means of teaching freshmen; would they be any more appropriate to a program for teaching the student what engineering really means? There is danger of their becoming perfunctory rather than inspiring. The student should take an active rather than a passive part in his guidance program.

The Counselor or Adviser System has many valuable features and should constitute an important part of every well-organized program of orientation. It should not have a too formal set-up such that the student will think of it as something separate and distinct from his studies in the first year. The counselor or adviser, if possible, should be chosen from the men who teach the subjects which have an engineering bearing, such as Mechanical Drawing, Shop-Work, Surveying, etc. In the opinion of the writer the best course for this purpose is Engineering Problems or Dean Williams' Study and Conference Course. And emphasis should be placed on a *study* course as distinguished from a course of lectures.

There would seem to be no reason why teachers of Chemistry, Mathematics and English, who have had experience therewith and who take a real interest in teaching engineering students, should not also co-operate in such a program.

Every wise, experienced and sympathetic teacher can be, and should be, a counselor or adviser to his students. If the objection be made that teachers with all these high qualifications are not as numerous as they might be, the answer is that such teachers can be had when the colleges begin to recognize that good teaching, with a sympathetic interest in the student and his problems on the part of the instructor, should have equal consideration as a criterion for advancement and promotion as is now given to research and productive scholarship.

Respectfully submitted for the Committee,

F. C. DANA,
E. R. WILCOX,
C. V. MANN,
R. L. SWEIGERT,
D. D. CURTISS,
P. S. BIEGLER,
W. D. TURNBULL,
DOUGLAS ANDERSON, *Chairman*

Discussion

R. L. SWEIGERT, Georgia School of Technology.

It has been stated, in comments received by the committee on orientation, that there has been too much talk on orientation. The writer agrees with that statement, but it certainly should not be confined to orientation. It applies equally well to many subjects that have been brought up for discussion in S. P. E. E. meetings. A large proportion of the topics have been surrounded with a great deal of useless talk, with relatively little application of the scientific approach to the problems of engineering education. It appears to the writer that it might be well to follow the nature of the meetings of some of the technical societies where research projects are presented for the benefit of the group. There should be a presentation of more authentic experimental evidence upon the problems confronting the engineering educator. There should be scientific educational research, of a type far beyond the stage of status studies. The status study is only preliminary to a real study of many of the existing problems.

This present work of this committee is in essence, a status study. It does not solve orientation problems. It does tell what is being done at present, and there is a small attempt at evaluating these practices. However there has been no authentic study of certain phases of orientation to get as indisputable evidence as possible to prove what is worthwhile and what should be disregarded. It is recognized that the operation of the orientation program is an institutional problem and that the mechanism may vary, but certainly there must be common underlying concepts, which if once established, will greatly aid any institution in developing its program. Two different engine manufacturers may build different engines, but the underlying fundamental principles are the same. Orientation is no different.

The first question in connection with this discussion is whether there should be any orientation. The fact that 88 per cent of the schools are now working with it as compared with 50 per cent in 1927, points to a need that must have been felt to furnish some transition to professional engineering. It is good educational psychology to lessen abrupt changes in the educational scheme in order to prevent maladjustments and to help make the work of the majority more effective.

If it is agreed that there is a need for some transitional program, then it is necessary to know what is the goal to be attained. Knowing the goal, a program to reach that point may be set up and each item of the program may be evaluated in terms of the degree to which it helps to attain the desired end.

It has appeared to the writer that usually when someone starts setting up objectives, he has the desire to set up as many items as possible to make a comprehensive looking program. A multiplicity of purposes for a program means difficulties, since it is impossible to meet a whole series of purposes in one satisfactory program. Experience seems to indicate that three objectives are sufficient for any program and one of these three should be predominant. Thus the whole program becomes an integrated whole leading towards a very definite result.

The following list of objectives taken from the report is given and each is briefly discussed.

1. To give the student the meaning of engineering and its relation to the economic and social order.

The importance of this statement is evident.

2. To teach the student the engineering mode of thinking.

This purpose may be put aside as far as orientation is concerned. Orientation is too short for such development, and also subject matter courses do that function much better.

3. To study the history of engineering.

This one may be set aside. It may be a means to giving the student a better understanding of engineering. It is not an objective. One of the causes for a multiplicity of objectives, sometimes lies in the confusion between the goal to be attained and the means by which that goal may be attained.

4. To introduce the student to the vocabulary of engineering.

This one may be set aside. The time is too short, and the professional courses are more suitable for that development.

5. To direct the student's attention to the ideals of the profession.

This one may be set aside. This purpose is better accomplished in the student technical societies. Also the effective application of ideals is taught, not by formal instruction, but by actual situations in which the ideal is demonstrated by life situations. The student must live it.

6. To assist the student in the choice of a professional field.

This purpose is vocational guidance. It has a place in orientation, though there is a variation of opinion as to its importance in connection with orientation.

7. To teach the student to study more effectively.

This one is important, since a fair share of the success of the student depends upon suitable study methods and habits.

8. To conserve student interest in engineering.

This one is a general purpose, and applies equally to all courses. By not only conserving, but also promoting interest, the educational process becomes more effective.

9. To introduce the student to college life and activities.

This one does not apply to engineering orientation, but in those institutions where there is no general university orientation, it must be included. Also it is felt that where the two programs are co-ordinated, a more effective situation results.

Summarizing, the objectives from the report might be stated as follows:

1. To furnish a transition to professional engineering. (An introduction to engineering.)
2. To help the student adopt efficient methods of study.
3. To introduce the student to college life and activities.

Several means of attaining these objectives, as taken from the report, are discussed below. It is quite evident from the above objectives that very little can be accomplished during orientation or freshman week. Only number three can be satisfied, in which the student is introduced to registration, the campus, and school traditions, with some time devoted to testing if tests are used. This objective can be very well attained by November.

In so far as an introduction to engineering is concerned, practically nothing can be accomplished while objective three is being attained. They are too different in character. Lectures seem to be the most widely used method of orientation, or preferably, of introducing freshmen to engineering. The only reason for the lecture system, as seen by the writer, is that it is the easiest to use. It also seems that it may be the least effective. The lecture method of teaching, particularly with freshmen, is likely to be highly ineffective. The retentivity from lectures is small, and notes made of lectures such as these, for future reference, are likely to be poor. Thus, except in special cases, lectures are one of the least promising means of accomplishing the purpose strived for. They should be used sparingly and with discrimination.

Problem courses are used by a few institutions. These alone appear inadequate, but used with discrimination, they may contribute something, just what the writer is not prepared to say. Their benefits seem doubtful, since some institutions that have used them widely have dropped them.

To aid the student in developing study methods, a text seems necessary. No lecture system is much aid here. Also, in order to make such study valuable, informal discussions with relatively small groups of students, seem valuable.

The counselor or advisory system seems to be used the most, next to the lecture system. Many advisory systems seem to fail to accomplish their purpose. They lack suitable student contacts, and fail to maintain contacts that are made. There seems to be a

big gap between the professor and the student. The counselor system may form part of the orientation program to the advantage of both. This is particularly true if the freshmen are divided into small groups that meet with a faculty member once a week in connection with orientation study, of the type, for example, in Dean Williams' book. The man in charge of each group has the opportunity to know personally the men in his section and to aid them in the best possible way, this aid coming about through student initiative, produced by the group-instructor contacts. There is little danger in doing too much for the student if it is kept in mind that opportunities for improvement should be provided, but that it is up to the student to have the initiative to use those opportunities. There is probably far more detrimental help given in regular class instruction.

Little mention has been made of the laboratories. It has been found that the laboratories can be very effectively used as an aid in the program of introducing freshmen to engineering, an aid that possesses very good motivation characteristics.

It appears from the viewpoint of interest and of a satisfactory meeting of the objectives set up, that any good orientation program is going to involve a combination of several methods, each one to provide the part that it can best provide.

DISCUSSION: OBJECTIVES IN ENGINEERING EDUCATION, BY D. C. JACKSON; AND, THE NEW ECONOMICS FOR ENGINEERS, BY W. E. HOTCHKISS

C. J. Freund (University of Detroit): Are not the most significant words in President Hotchkiss' address the statement that shying away from the human problems is sometimes a direct hindrance to engineering progress? Is it not possible that our viewpoint and our method of teaching engineering more or less prevent the development in the student of those characteristics which are most necessary for engineering success?

Data show that more than sixty per cent of engineering graduates ultimately get into the management phase of the profession, and in that phase of the profession, whether we like it or not, the most important and the most valuable factor is the ability to make shrewd judgments when precise quantitative data are lacking. The man who solves problems by means of quantitative, scientific data is always in a stratum somewhat inferior to that of the highest officer. The thing which distinguishes the highest officer from the man who depends upon quantitative data is the ability and courage to go ahead and make a decision when quantitative information cannot be had. That is the kind of work that sixty per cent of our engineering graduates get into.

The above suggests a question: Are we right in maintaining in the engineering colleges the superiority of that kind of thinking and procedure which involves primarily the accumulation and use of quantitative experimental information?

It seems to me that the social sciences, the sort of thing that President Hotchkiss and others this afternoon have been talking about, are becoming so important in their bearing upon training for management that we have got to give them a place and a recognition equal to that of the natural sciences. I wonder whether these departments of instruction, in which precise measurements are not now possible and may not be possible for years, are not entitled, in view of the circumstances, to all that superior status and distinction in the faculty which we now give to our departments of science, of engineering, and of mathematics. Until such recognition is granted, the boy will still shy away from human problems and will cultivate the scientific at the expense of the social and afterwards, out in industry, he will be forced to yield to the man who does not know quite so much about science and applied

science but who has learned more about the judgment which guides industries and leads men.

H. S. Rogers (Brooklyn Polytechnic Institute): I agree most heartily with what has been said this afternoon by most of the speakers. I appreciate the emphasis which has been placed upon the need for training in the social sciences and particularly in the field of economics. I want to call attention, however, to one point in Professor Jackson's paper on the training of students for the development of personal qualities. I do not think that we can assume the task of doing too much in that field. Any of you who have read the seven objectives of the National Education Association with any critical thought whatsoever will recognize that they have left little room for the home, for the church, or for any other influences. I doubt very much if we in the classroom teaching mathematics, structures, dynamo electricity, can have any very profound effect upon the moral and human qualities of the boys who are under our tutelage. The influences upon their characters in those aspects are coming from elsewhere than in the classroom.

It has been my pleasure to serve on a board handling loan funds of no mean magnitude for students. I approached that board with the assumption that a student who was working his way through college and making good grades would be a worthy recipient of a loan and a good risk. After five years of work on the board I came away sorely disappointed. Some of the poorest students who come to us were the most reliable and had the greatest sense of financial responsibility, of honesty, and of integrity. There is no correlation—no complete correlation—between intellectual qualities and personal honesty. It seems to me that in so far as we do influence the moral and the human nature of students we do so quite indirectly. On the other hand, we do have a direct leadership in the development of their intellectual qualities.

I was very much pleased to hear President Hotchkiss say that he believed that courses in business and in public policy were much more adaptable to the instruction of engineers than courses in the principles of economics or in classical economics. There, it seems to me, is the field which we must develop. It may be said, in another way, that we need courses in production economics and in construction economics, in the fields of economics that have as yet only been casually developed. If we are to have courses of that kind we must have men upon our faculties who can participate in the development of them and who have the ability and the creative capacity to add to human knowledge in that field, and I think that the Armour Institute of Technology is to be complimented upon the work which they are undertaking in the development of such courses.

Another point with regard to the social sciences: I am not very sympathetic toward that almost trite expression that the social sciences have not been developed to the extent the physical sciences have been, and that when they are developed they may be as constructive in society as the physical sciences have been. I doubt if the social scientists are conscious of the fact that physical science is method and is applied to ends always predetermined. When a man wants to design a bridge he knows what he wants to do. When a man wants to design an engine he knows what he wants to do and his science is a means to an end which is not determined by science at all. When society knows what it wants to do, whether it wants to "share our wealth" or whether it wants to set up "social justice" or whether it wants to do any other of the various things that we hear about to-day, I think that social science as a method may be used, but the determination of ends is a matter of philosophy, it is a matter of moral responsibility, it is a matter of social ethics, and it is a matter which society must first determine before science as a method will be of much value.

G. W. Barnwell (Stevens Institute of Technology): For fear no one else will say it, I want to take this opportunity to thank Professor Jackson and President Hotchkiss for doing for us teachers of management and applied economics in engineering schools the thing that we have some difficulty in doing for ourselves, namely, getting our viewpoint across to you teachers of technical engineering subjects.

I am quite sure that the teachers of applied economics and management and allied subjects have no idea of making economists out of engineers. We are fully aware, I believe (and in fact I know), that the purpose of engineering schools is to turn out good technical engineers. If sixty per cent (my figures are 75 per cent) of our engineers, twenty-five years after leaving college, are not doing anything that could be called strictly technical engineering work, but are carrying out various executive functions in business and finance (we have a Stevens' graduate who is a minister) still we know that we are not trying to make economists out of engineers. We have some difficulty in getting across to the technical staffs in our various colleges that there is really anything in economics. I am afraid that much of it is due to the fact that you have the viewpoint of President Hotchkiss, and it is held by many others, that when we say economics we mean economic theory. Not many teachers of management and applied economics waste much of their time on economic theory. I think it is common practice in the larger educational institutions to have economic theory taught in the Department of Economics, and many of those men, if I do say it, are rocking-chair economists.

I am not in full agreement with President Hotchkiss. I believe that a course in economic theory has a place in an engineering curriculum, but I believe it ought to be taught by an engineer and taught with examples drawn from engineering and industry rather than from the field of agriculture, but that is a moot question.

As far as accounting is concerned, I have never met a graduate engineer yet who did not more or less regret the fact that he did not have any accounting, and there are various other subjects.

I want to thank these gentlemen for doing for us what we have had some difficulty in doing for ourselves and that is to enlist the sympathy of the technical staffs of the various departments for us in trying to make better engineers and not trying to turn engineers into economists.

WHITHER TECHNICAL INSTITUTES?

By PARKE R. KOLBE,

President, Drexel Institute.

Editor's Note: President Kolbe should be able to speak impartially upon the problems presented in this article since he has under his direction the standard collegiate type of engineering college in the day session at Drexel Institute, and the technical institute type of training in the evening session at the same institution.

The value of the non-degree granting technical institute has been freely admitted by the engineering world. In fact it has been impressively and officially documented, as witness the following:

> The situation in industry warrants a great expansion of technical education above the present level of the secondary schools. There should be a greater diversity of technical education to serve a wider variety of individual and industrial needs. To maintain but one type of school (the engineering college), and to ask it to meet all purposes is to invite blurring of aims and compromise of standards. The need is for schools having more definite purposes and more clearly visualized aims.
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> From the Summary of Results of the Investigation of Engineering Education and Related Activities (1922–1933), by Charles F. Scott, Chairman of the Board of Investigation and Coördination, published by the Society for the Promotion of Engineering Education, 1934, page 27.

In his Survey of Adult Technical Education in the New York Industrial Area (Chamber of Commerce of the State of New York, 1932) Mr. O. W. Eshbach says under the caption "A Needed Change of Viewpoint":

> It is felt that the development of our degree-granting institutions has so overshadowed all other forms of technical education that undue prominence is given to the four-year curricula. This situation cannot be corrected or other forms of technical education developed unless there is a change of viewpoint, both industrially and socially. A more general acceptance of the idea of education for the sake of acquiring useful knowledge and skill, rather than the acquisition of an academic degree is needed; also a closer coöperation between employers and educators in the establishment of programs of instruction helpful to the employed.

In view of the opinions quoted above it is interesting to note some of the factors which have recently reacted unfavorably upon the technical institutes and which have made their continuance as technical institutes increasingly difficult.

The recently formed Engineers' Council for Professional Development, among other laudable activities, has through its Committee on Engineering Schools, undertaken the preparation of a list of acceptable engineering colleges. Insofar as my information goes, no plans have been made by this committee to include technical institutes in its survey of engineering institutions. This seems to me particularly unfortunate in view of the condition portrayed by Professor Scott in the Summary mentioned above (pp. 29–30):

> A lack of solidarity among the existing technical institutes has held back the development of similar schools over the country at large. Each institution has grown up around some local situation or some individual's vision, but with little sense of aims in common with other schools. Their heads have wisely sought to preserve this individuality. The result has been an emphasis on points of dissimilarity, amounting to a spirit of mutual aloofness. Thus separated, they have been unable to create a recognized status of their own. They were too often known as non-this or non-that to impress themselves on the consciousness of the country, much less its imagination. Their faculties suffer from a sense of professional isolation. There was no forum for their common problems and no organization for a united initiative.
>
> Technical institutes have been handicapped by the fact that their graduates received no educational credentials which are nationally recognized. The temptation has been strong to become colleges and award degrees. British educational authorities and professional societies have met a similar problem most effectually through the establishment of National Certificates, National Diplomas, and Certificates in Technology awarded by central bodies.

Of even greater adverse significance for technical institutes is the growing tendency to restrict the practice of engineering through systems of state licensing. Licenses for the practice of engineering are usually granted (after examination) on the basis of training and experience, the experience requirement being greatly diminished for holders of engineering degrees, and but little or not at all diminished for graduates of technical institutes. Thus the latter may find himself faced by the necessity of presenting an excess of experience over that of his degree-holding colleague which is entirely out of proportion to the usual two years difference in the length of their respective courses.* For example in New York State the requirements are:

* It should be stated in fairness that there is sometime also a difference in the *formal* requirements of secondary school preparation. However the good technical institutes, while often disregarding formalities in the case of adult students are careful to retain as students only those who are capable of doing good work.

The graduate of a four-year engineering college is required to present only four years of acceptable practical experience for admission to the state examination, for a professional license, while the graduate of a technical institute, although he may have spent only two years less in study, must present *twelve* years of practical experience for admission to the same examination.

In Pennsylvania registration as a professional engineer may be secured by the graduate of a four year school upon completion of two additional years of acceptable practical experience. No mention is made of the graduate of the technical institute and it is to be inferred that he must be classed with the man without any formal training for whom the requirement for registration is *ten or more* years of practical experience. This discrimination against the technical institute graduate is, to say the least, disheartening and is bound to influence adversely the continuance of technical institutes.

In one case which has come to my knowledge a great technical institute in the New York area was actually threatened by a licensed engineer with a lawsuit for offering two year *engineering* courses, since the use of the term engineering was, in his estimation, legally limited to degree granting institutions.*

In accordance with the tendencies above noted, the United States Civil Service Commission at present refuses to recognize the two year course of technical institutes (as a class) as sufficient for admission to examination for certain positions on the civil service list, although for the same positions they are entirely willing to accept the first two years work of a standard four year engineering college.

Finally, a very definite share of the responsibility must be attributed to the effects of the general public attitude toward higher education, an attitude which has embalmed the four-year course as a sine qua non of academic respectability, and a college degree as the essential mark of a completed education.

As a result of the conditions just described, the graduate of a technical institute finds himself faced by several unfortunate conditions which have a directly adverse bearing upon his future career:

* Since the above was written Governor Lehman of New York has signed the McNaboe bill. Under this law, "no person can use any name, title or descriptive material indicating or tending to imply that he conducts a school of (among others) architecture or engineering unless the right to do so shall have been granted by the Board of Regents under its seal." Since the Regents of the University of the State of New York have been prepared to register only four-year, degree-granting colleges, the status under this law of non-collegiate technical institutes in New York remains ominous and doubtful.

1. His particular type of school has no form of inter-institutional organization and the only committee which speaks for the whole engineering profession and is active in separating the sheep from the goats in the technical world is for the present at least interested in engineering colleges alone.

2. State Licensing Boards seem to regard him as rather small fry or they ignore him utterly and his road to an engineer's license is a long and difficult one.

3. The U. S. Civil Service Commission does not allow him to try for certain positions which would be open to him if he had spent his two years at a standard four year engineering college.

4. By the nature of his course he is virtually shut off from continuing his work for a degree in a standard engineering college without great loss of time, *i.e.*, his course can rarely be adjusted so that he may receive a degree in two additional years.

5. Industry in other fields which he might enter has a considerable choice under present economic conditions of degree graduates, and is disinclined to extend to him the hearty welcome of twelve or thirteen years ago, a welcome so attractively portrayed in the Investigation of Engineering Education of 1922–1933. Truly the name *Terminal* Course, so often applied to the offerings of the technical institutes, has today taken on a sinister significance. The graduate from one of these is liable to find his institution praised in theory and damned in practice. As a result some technical institutes today are seriously considering the desirability of becoming four-year institutions and thus of putting themselves in recognized and respectable company.

It would seem to an observer that the remedy lies with the engineering profession itself. Is it to offer a mere lip service of admiration to these institutes, or is it to offer them real help in securing proper recognition for their courses and in opening up the blind alleys which so many of their graduates face?

Specifically at least a few of the things which might be undertaken are immediately suggested by the conditions described above. Certainly an effort should be made to encourage professional unity among the technical institutes. Perhaps they themselves are at fault in their lack of an active organization of their own representative institutions. Accrediting, too, is perhaps more important for the technical institutes than for the engineering colleges. The Engineers' Council for Professional Development might well consider the appointment of a special committee to deal with the standards and other educational problems of the technical institutes. State Licensing Boards might consider the possibility of examinations for a special type of engineer (to be called by some distinctive title) for which the graduates of technical institutes

could more readily qualify, and full opportunity should be given to the successful candidate in these examinations to pass without too great loss of time to the regular engineer's examinations. If such intermediate standards were set up, the various Civil Service Commissions would no longer find it so difficult to know which Institutes to accredit. Finally the whole engineering profession, especially as represented in the Society for the Promotion of Engineering Education,* should give careful attention to the possibility of closer coördination between the work of the technical institutes and the engineering colleges, with the general object in view of opening up the dead end road and making easier the transfer from the lesser to the greater curriculum.† At the same time the methods in use in Great Britain to dignify the work of these institutes is worthy of careful study and some imitation. The present writer believes that technical institutes are doing an admirable work and that they are well worth saving.

* See in this connection the excellent report of the Committee on Technical Institutes of the S.P.E.E., JOURNAL OF ENGINEERING EDUCATION, February 1935, pp. 394 ff.

†This problem has already seriously engaged a few of the best minds in the field of engineering education and has provoked some original thought. Particularly challenging is the paper of Dean F. E. Ayer, of the University of Akron, on "Semi Professional Engineering Education" (JOURNAL OF ENGINEERING EDUCATION, February 1933, pp. 463 ff.). See also "Engineering Education Needs a Second Mile," by President W. E. Wickenden of Case School of Applied Science, *Electrical Engineering*, May 1935, pp. 471 ff.

NEW MEMBERS

BROTHER AUBERT, Head, Department of Engineering Mechanics, Manhattan College, New York City. David J. O'Connell, William R. Denue.

BUTLER, JOHN H., Instructor in Mechanical Engineering, New Mexico College of A. & M. Arts, State College, N. M. H. M. McCully, F. L. Bishop.

HAYES, LESLIE D., Professor of Machine Design and Construction, West Virginia University, Morgantown, W. Va. G. P. Boomsliter, R. P. Davis.

HICKS, JAMES R., Assistant Professor of Power Engineering, Thayer School of Civil Engineering, Dartmouth College, Hanover, N. H. Frank W. Garran, Wm. P. Kimball.

HITCHCOCK, RICHARD C., Electronic Engineer, Meter Engineering Dept., Westinghouse E. & M. Co., 95 Orange Street, Newark, N. J. Chas. F. Scott, E. B. Roberts.

HOWES, DOUGLAS E., Associate Professor of Electrical Engineering, Norwich University, Northfield, Vt. A. E. Winslow, F. W. Garran.

MORRIS, SAMUEL B., Professor of Civil Engineering, Stanford University, Stanford University, Calif. Franklin Thomas, John R. Macarthur.

STRELZOFF, JOSEPH A., Chairman, Engineering Department, Keystone Junior College, LaPlume, Pa. F. L. Bishop, Nell McKenry.

THOM, GEORGE B., Assistant Professor of Engineering, Swarthmore College, Swarthmore, Pa. Chas. G. Thatcher, Howard M. Jenkins.

The T-SQUARE PAGE

DEVOTED TO THE INTERESTS OF THE DIVISION OF ENGINEERING DRAWING

FREDERIC G. HIGBEE, EDITOR

A New Year: By the time this article is read, engineering colleges will have started a new year, and teachers of engineering drawing will be facing classes of entirely new students. This circumstance is fraught with a dual significance: will teachers meet their classes with the zest and enthusiasm a new year should stimulate, and will the new students make the most of the opportunities now theirs by virtue of enrolling in an engineering course?

Of the latter question little need be said here. Students have been, are, and likely always will be variable in their responses to opportunity. During the late depression, opinion has stated, students have acquired a better and more substantial attitude.

But what of the teacher? Once a well-known and well-beloved engineering professor stated that he never reached the end of an academic year without making solemn vows to do a better job next year. It might indeed be well for teachers to open the year with some such thought in mind. A sculptor with an unformed mound of clay before him, a painter with a new canvas on the easel, a draftsman with a fresh sheet of paper on the board, a teacher with a new class—what a background for creative work! And of all creative workers what rich opportunities are the teachers'. The very fascinating and human enterprise of imparting knowledge, in the intimate and friendly atmosphere of the drafting room, gives teachers of engineering drawing an opportunity they should highly prize, and a serious responsibility.

SECTIONS AND BRANCHES

The Program Committee for the newly formed **Allegheny Section** of the S. P. E. E. met in the office of Dean Davis of the University of West Virginia. At this meeting the Committee outlined the program for the meeting of the Section which will be held at the Carnegie Institute of Technology, Pittsburgh, Pa., Friday, November 8, and Saturday morning, November 9.

The general topic of the Friday afternoon meeting will be the work of the Engineers' Council for Professional Development. The following will discuss different phases of this work: R. I. Rees, American Telephone and Telegraph; Dean R. L. Sackett, Pennsylvania State College; W. W. Hodge, West Virginia University; J. N. Chester, practicing engineer of Pittsburgh; and William E. Wickenden, President, Case School of Applied Science. Friday evening will be devoted to a dinner at the Carnegie Inn and theater party at the Little Theater of the Carnegie Institute of Technology. Professor Elmer Kenyon, Head of the Department of Drama will present Shakespeare's "Anthony and Cleopatra."

Saturday morning, the program will consist of a series of conferences organized about the interests of the following group:

(1) Electrical Engineering and Physics.
(2) Chemical, Mining and Metallurgical Engineering.
(3) Mechanical Engineering.
(4) Mechanics and Civil Engineering.
(5) Commercial and Industrial Engineering, and Shops.

The general topic of these conferences will be "The Effect of Present Tendencies in Professional Development upon Teaching Programs." The program for each separate conference is expected to include:

(*a*) One formal paper of twenty minutes.
(*b*) A series of five 8 minute contributions by representatives of each of the institutions participating in the conference.
(*c*) A period of one hour directed to Seminar type of discussion in which it is hoped that all those present will participate.

The Organization Committee of the Allegheny Section extends a most cordial invitation to all members of the S. P. E. E. who may be in the vicinity of Pittsburgh at this time to attend this meeting.

Further information concerning the meeting may be had by writing to H. M. McCully, in care of the Carnegie Institute of Technology, Schenley Park, Pittsburgh.

The **Middle Atlantic Section** will meet at the Engineering Building of the University of Pennsylvania, Philadelphia, Pa., on Saturday, November 2. All members are urged to attend and bring their friends.

The **Colorado School of Mines Branch** of the S. P. E. E. held its annual spring meeting in Golden. It was unanimously voted to retain the present officers for the ensuing year, a list of which is submitted herewith: President—Roscoe W. Morton; Vice President—Arthur S. Adams; Secretary-Treasurer—George W. Salzer.

GEORGE W. SALZER

The Spring Meeting of the **Middle Atlantic Section** of the Society was held at Princeton University on May 11, 1935, and was attended by approximately 200 members and guests. The morning was spent in visits to the laboratories of physics, chemistry and biology and in inspection of the beautiful buildings and grounds of the university.

At one o'clock luncheon was served in the Engineering Building and immediately thereafter Dean Arthur M. Greene, Jr. welcomed the assemblage to Princeton's Halls of Learning. Chairman Dean Franklin DeR. Furman was in the chair. The minutes of the Stevens meeting were read and approved, as was also the treasurer's report, which told of the balance on hand of forty cents. The secretary-treasurer was authorized to levy an informal tax of $1.00 upon the membership of the section. The following Princeton professors presented interesting and valuable papers:

J. Douglas Brown, of the Industrial Relations Section of the Department of Economics, spoke on the activities of that section in instruction; library, the facilities of which are used by students and instructors both at Princeton and other institutions of learning, and by executives of various companies; research, carried on largely by graduate students; advisory capacity, which is carried on mostly in conjunction with the government; and the conference function, in which executives of industrial concerns meet with the Princeton representatives.

Hoyt H. Hudson, of the Department of English, told of the work of his course on Oral and Written English, given to senior engineers for two hours a week during one term, in which papers of a varied nature, some technical, some non-technical, are presented by the students.

Hugh S. Taylor, Research Professor of Chemistry, told us about heavy water and the work that has been done in the developing of it, its uses in chemical reactions as an indicator, and its biological effects.

Clodius H. Willis, Professor of Electrical Engineering, presented the fourth paper on Constant Current Power Transmission. which, he predicted, will be used in underground transmission systems of moderate distances and in non-synchronous ties. It is a new engineering tool which will not displace present practice to any extent.

Professor H. P. Hammond presented the following resolution, which was unanimously carried.

The Middle Atlantic Section of the Society for the Promotion of Engineering Education at its meeting at Princeton University, May 11, 1935, voted unanimously to join in the invitation extended to the Council of the Society to hold the Annual Convention within the boundaries of the Middle Atlantic Section in the year 1936–37 or 1938 at the Society's convenience. The Section endorses the plan whereby Columbia University will act as Host to the meeting under the general sponsorship of the colleges of engineering of the Metropolitan District of New York, in whose name the invitation is extended.

The meeting then adjourned to meet in small groups in various classrooms of the engineering building to discuss the papers.

Some of the members and their wives and sweethearts attended a most delightful reception at the beautiful home of Dean and Mrs. Arthur M. Greene, Jr.

After inspection of the various engineering laboratories, the section reconvened at the Graduate College where dinner was served to 157. Dean Eisenhart of the Graduate School welcomed the assemblage and spoke on some of the progressive features of education being carried on at Princeton. Major C. F. Hirshfeld spoke on the present work of the Engineering Council for Professional Development, one of the ideals of which in the training of the embryo engineer, is to make him a less technically centered, and a more socially minded individual.

The Committee on Meetings, consisting of Messrs. J. C. Elgin of Princeton, F. S. Egilsrud of Pratt, M. C. Stuart of Lehigh, R. C. H. Heck of Rutgers, and Morland King of Lafayette, Chairman, recommended that the section accept the invitation of the University of Pennsylvania for the 1935 fall meeting, and the invitation from Union College, seconded by the General Electric Company and Rensselaer, for the 1936 spring meeting.

CHAS. G. THATCHER,
Secretary

At a meeting of the **North Carolina State College Branch** of the S. P. E. E., held May 27, the following officers were elected to serve for the academic year 1935–36: R. P. Kolb, Chairman; J. M. Clarkson, Vice-Chairman; H. E. Satterfield, Secretary-Treasurer.

The members of the Branch expressed a desire to revert to the former custom of holding six stated meetings each year and every effort will be made to adhere to this program during the coming session.

According to our established policy, the meetings of the Branch become a special order of business at meetings of the engineering faculty in order that the largest possible number of the members of the faculty may take advantage of the program offered.

R. P. KOLB,
Chairman

A meeting of the **Pennsylvania State College Branch** of the Society for the Promotion of Engineering Education was held in Room 107, Main Engineering with Professor L. S. Rhodes, President, presiding.

The minutes of the preceding meeting were read by the Secretary and approved as read.

"My impression of the Ithaca Meetings" was the topic of the first discussion. Professor R. O'Donnell spoke of the Conference on Hydraulics. He thought it was of great value, especially the model studies. It was more intimate because smaller than the general meeting and led to the formation of associations. He complimented the Cornell faculty for the clock-like manner of running the convention. He thought that the papers presented at the meetings could be better read than listened to, since the time of presentation was too short.

Professor E. B. Stavely continued the discussion. He reviewed his reactions to the conference on Electronics and Electrical Communications. He stated that he went to the conference for the purpose of obtaining information about the experiences of other teachers in undergraduate courses dealing with Electronics and the application of electronic devices in the general engineering field. In view of this objective, he was disappointed with the conference owing to the fact that there was very little discussion relating to undergraduate work in the field of Electronics, most of the time being devoted to discussion relating solely to the field of communication, to a few items of specialized subject matter presented in graduate courses by a few institutions, and to electrical engineering curricula in general. He was of the opinion, however, that the conference should have been very satisfactory to those interested in telephony and radio, and especially attractive to those engaged in graduate instruction in these fields.

Dean R. L. Sackett reminded the group that methods of teaching and not technical information were the objectives of the con-

ferences. He stated that a formal invitation had been extended to the S. P. E. E. to hold its convention at Penn State in 1936.

Professor L. S. Rhodes spoke of the Fluid Mechanics Conference. He said that the speakers talked about advanced problems in the mathematics of hydraulics and were not presenting methods of teaching hydraulics to undergraduates. He thought that the conferences had great possibilities and were of more interest than the general convention.

Professor F. C. Stewart, who was Chairman of the Conference on Heat Flow and Transmission, said that he hoped they had stuck to their subject.

Professor A. E. Neyhart then began the second discussion which was on the rest of the facts on correlations between student grades in different subjects and graduation average. In a previous talk to the group, he had given the results of correlation on some 200 cases. Since then 1000 cases have been studied. These were from the records of the classes of 1930 to 1934 inclusive of the School of Engineering. This correlation has been done by departments for all freshman and sophomore subjects, singly and by combinations, and for subjects peculiar to course. Professor Neyhart reminded the group that the correlation figures were a measure of the probable scholastic success at Penn State. In answer to a question he outlined the correlation figures: -1 to 0 means disagreement; 0 to $+1$ means agreement; -1 means perfect disagreement; and $+1$ means perfect agreement. He stated that Descriptive Geometry has the best correlation, considering the number of credits involved, followed by Mathematics, Physics, and Chemistry. This brought out the fact that those subjects which had objective measure gave the higher correlation. Thus English, which is not objective, gives a low correlation, and the same is true of the orientation courses. Some correlation figures given by Professor Neyhart are as follows:

Department	*Mathematics*	*Chemistry*	*Descriptive Geometry*	*First Year*
A. E.	0.63 ± 0.07	0.58 ± 0.10	0.61 ± 0.07	0.72 ± 0.04
C. E.	0.71 ± 0.05	0.73 ± 0.04	0.64 ± 0.06	0.78 ± 0.04
E. E.	0.72 ± 0.03	0.68 ± 0.04	0.61 ± 0.04	0.81 ± 0.02
I. E.	0.69 ± 0.07	0.71 ± 0.07	0.57 ± 0.10	0.78 ± 0.05
M. E.	0.71 ± 0.05	0.71 ± 0.05	0.59 ± 0.07	0.82 ± 0.03

In answer to a question by Dean Sackett concerning the best single indicator, or combination, Professor Neyhart said that Mathematics and Descriptive Geometry should be watched regardless of department.

Professors Hanrahan, Allen and Walker asked about indicators before the end of the first year. This led to a discussion of the comparative tests in English and Mathematics given at Penn State to the freshman Engineers. Professor Tebo said that the correlation appeared difficult due to the difference in High School preparation. Professor O'Donnell told of Registrar Hoffman finding agreement between success in High School and at Penn State.

Professor Walker remarked that the objective of all these correlation studies was to help the student, but that student habit in regard to other things than study had a great deal to do with his success.

Professors Doggett, Torrence, Stavely, Bullinger and Rhodes rose to the defense of the orientation courses.

Professor Rhodes then closed the meeting with the remark that we had better have another meeting on the subjects of Correlation and Orientation, to which Professor Stavely suggested the subject of the Student Advisory Capacity of the Engineering Faculty; and Dean Sackett added that we are not through with "Too many Engineers," since another paper on this subject had appeared by Mr. D. B. Steinman in the Journal of the Association of Professional Engineers of New York State.

ALBERT P. POWELL,
Secretary

The **Southeastern Section** of the S. P. E. E. was called to order by the temporary Chairman, Dean Floyd Field, at 11 A.M., June 24, 1935. This meeting was arranged in connection with the forty-third annual meeting of the S. P. E. E. held at Georgia Tech, June 24 to 27. The following colleges and representatives were in attendance.

North Carolina—
University of North Carolina, Chapel Hill, N. C.
E. W. Winkler, Wm. J. Miller
Duke University, Durham, N. C.
R. S. Wilbur.
Louisiana—
Tulane University, New Orleans, La.
Douglas S. Anderson, W. B. Gregory, C. W. Ricker, D. S. Elliott, James M. Robert.
Louisiana State University, Baton Rouge, La.
Hamilton Johnson, L. J. Lassalle, G. F. Matthes, T. W. Neff, B. W. Pegues, F. F. Pillet, Geo. H. Simon, M. B. Voorhies.
Alabama—
University of Alabama, Tuscaloosa, Ala.
J. R. Cudworth, Geo. J. Davis, Jr., Fred R. Maxwell.
South Carolina—
Clemson College, Clemson, S. C.
E. L. Clarke, S. B. Earle, D. H. Shenk.

Georgia—
Georgia School of Technology, Atlanta, Ga.
N. C. Ebaugh, J. L. Ellis, Dean Floyd Field, Dean D. P. Savant.
Maryland—
University of Maryland, College Park, Md.
S. S. Steinberg.
Kentucky—
University of Kentucky, Lexington, Ky.
C. C. Jett.
University of Louisville, Louisville, Ky.
D. M. Bennett.
Virginia—
University of Virginia, University, Va.
Dean W. S. Rodman.
Florida—
University of Florida, Gainesville, Fla.
Dean B. R. Van Leer.

The Chairman presented a brief review of the former meetings of these representatives and followed the instructions of the group which met at Georgia Tech November 9 and 10, 1934. The authority had been secured from the Council of S. P. E. E. for the organization of a Southeastern Section of the S. P. E. E.

The Chairman then read the constitution, which upon motion, was carried unanimously to be adopted as the constitution of the Southeastern Section of the S. P. E. E.

CONSTITUTION and BY-LAWS adopted for the Southeastern Section of the S. P. E. E., June 24, 1935.

CONSTITUTION

ARTICLE 1

Name and Purpose

Section 1. The name of this organization shall be the Southeastern Section of the Society for the Promotion of Engineering Education.

Section 2. The purposes of this Section shall be in accordance with those for the National S. P. E. E.

ARTICLE 2

Membership

Section 1. Membership in this Section shall be any members in good standing in the National S. P. E. E. Any persons interested in Engineering Education will always be welcome at the meetings of this Section.

ARTICLE 3

Dues

Section 1. This Section shall have no fixed dues. It shall be financed by contributions from the individual members whenever such contributions become necessary by vote of the Section.

ARTICLE 4

Officers

Section 1. The officers shall be a Chairman, a Vice-Chairman, and a Secretary elected annually, and each will serve until their successors have been elected.

ARTICLE 5

Meetings

Section 1. Regular meetings shall be held annually at such time and place as the Section shall vote from time to time.

Section 2. Other meetings may be called at the discretion of the officers of the Section.

Section 3. A quorum shall consist of a majority of the Engineering schools represented in the group indicated as the Southeast.

STATES AND COLLEGES IN SOUTHEAST SECTION

Alabama—
Alabama Polytechnic Institute, Auburn
University of Alabama, University

North Carolina—
Duke University, Durham
University of North Carolina, Chapel Hill
N. C. State College, Raleigh

South Carolina—
The Citadel, Charleston
Clemson College, Clemson College
University of South Carolina, Columbia

Florida—
University of Florida, Gainesville

Kentucky—
University of Kentucky, Lexington
University of Louisville, Louisville

Louisiana—
Louisiana Institute, Lafayette
Louisiana State University, Baton Rouge
Tulane University of Louisiana, New Orleans

Maryland—
Johns Hopkins University, Baltimore
University of Maryland, College Park
U. S. Naval Academy, Annapolis

Mississippi—
University of Mississippi, University
Mississippi State College, State College

Tennessee—
Tennessee Polytechnic Institute, Cookeville
University of Tennessee, Knoxville
Vanderbilt University, Nashville

Virginia—
Virginia Military Institute, Lexington
Virginia Polytechnic Institute, Blacksburg
University of Virginia, University
Washington and Lee University, Lexington

Georgia—
Georgia School of Technology, Atlanta

ARTICLE 6

Amendments

Section 1. This constitution may be amended at any regular meeting by a majority vote of the members present provided a quorum is present and provided notice has been sent in writing to the members at least two weeks in advance of the date of the meeting.

By-Laws

Section 1. The Chairman of the Section shall be ex-officio a member of all committees.

Section 2. The officers of the Section shall constitute the executive committee and the program committee.

Section 3. Officers shall be elected at each annual meeting to serve until their successors have been elected and qualified.

Section 4. These by-laws may be amended at any regular meeting by a majority vote provided a quorum is present.

The Section then elected the following officers to serve for the balance of this year: Chairman, Dean Floyd Field, Georgia Tech; Vice-Chairman, Dean L. J. Lassalle, Louisiana State University; Secretary, Professor N. C. Ebaugh, University of Florida.

The Chairman then announced Dean Van Leer who reported for the committee which was appointed in November to secure data concerning five-year courses. He made the following report for the committee.

COMPILATION OF RESULTS OF QUESTIONNAIRE CONCERNING FIVE-YEAR CURRICULUM FOR ENGINEERING SCHOOLS SOUTHEASTERN SECTION, S. P. E. E.

Questions Asked

1. Do a majority of the engineering faculty of your institution believe a five-year curriculum would be desirable for Engineering students?

2. Would you be willing to endeavor to have such a program adopted for your institution if a majority of other Southeastern engineering schools would agree to such a program?

3. Is 1940 an appropriate year in which to make such an agreement effective?

4. Would your faculty favor an arrangement of this kind:

(*a*) For the completion of 64 cr. hrs. of undergraduate collegiate work the awarding of the Junior certificate in Engineering?

(*b*) For the completion of 128 cr. hrs. of undergraduate collegiate work in engineering the awarding of the B.S. in Engineering (B.S.E.)?

(*c*) For the completion of 160 cr. hrs. of work, 32 cr. hrs. of which would be specialized in a particular field, the awarding of the B.C.E., B.E.E., etc.?

Number of questionnaires sent out	33
Number of replies received	26

Answers

	No. 1		No. 2		No. 3		No. 4(*a*)		No. 4(*b*)		(No. 4*c*)		Remarks
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Ala. Univ.		(no answers)											
Ala. Ply. Inst.		×	Does not favor 5-year curriculum.										
Ark. Univ.		×	×		× (or later)					×	×		
Clemson Col.		×		×				×		×			Will follow majority.
Duke Univ.		×	×										
Fla. Univ.	×		×		×			×	×		×		
Ga. School Tech.	×	(24–20)	×										Will follow majority.
Ky. Univ.		×		×				×		×		×	Would agree if general over entire country.
Md. Univ.		×	×	Strictly opposed to 5-year curriculum, but would follow majority.									
N. Car. Univ.	×		×		×	(before)		×		×		×	
N. C. State	×		×		×			×			×		
Okla. A & M		×	×										
Okla. Univ.		×	×			×	(Later)						
Rice Inst.		×		×									
S. Car. Univ.		×		×			×		×		×		
So. Meth.		×		×				×		×		×	Would probably favor if 5th year was on graduate basis.

	No. 1		No. 2		No. 3		No. 4(a)		No. 4(b)		(No. 4c)		Remarks
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Stetson Univ.	×		×		×		×		×		×		Favors pre-einginnering work about 1½ years.
Tenn. Univ.		×		×		×	(Much Later) Strictly opposed to 5-year curriculum.						
Texas A & M		×		×			×		×		×		Would follow majority if movement was nation-wide.
Texas School of Tech.	(no answers—impossible to adopt now—not considered by faculty.)												
Texas Univ.	×		×					×	×		×		Would adopt only if 3/4 majority did so.
Tulane Univ.	×		×		×			×		×		×	
Vanderbilt Univ.		×		×				×		×		×	
Va. Poly.	×			×				×	×		×		Sentiment of small majority of faculty. Dean Norris opposed. Thinks it should be started by schools in North.
Va. Univ.	×		×		×			×		×		×	
W. Va. Univ.		×		×									
	9	−15	13	−10	7	−2	3	−12	6	−8	8	−6	

In response to the request for suggestions as to title for the degree to be awarded after two years of general study and three years of specialized work in engineering, the following results are found:

Bachelor of Engineering (Civil) 2
Bachelor of (Electrical, etc.) Engineering 4
EE, CE, ME, Che, etc. 1
Bachelor of Science in Engineering 1
Professional Degree 1

SOME REFLECTIONS ON THE ENCLOSED QUESTIONNAIRE

By W. S. RODMAN

I feel that on the whole the results achieved by the questionnaire are encouraging rather than discouraging from the viewpoint of those of us who favor a lengthened curriculum for the proper training of those students of engineering who may properly anticipate a responsible place in their lifework. The return of 26 out of 33 with 24 making some definite return is a goodly sign that the questions raised were of sufficient general importance to bring an answer.

The indication that more than half of those replying would undertake to set up such a lengthened program if it should be rather generally adopted is a long step toward obtaining the object, which I believe would have been quite impossible a few short years ago.

It is undoubtedly true that there is much confusion with regard to the objectives which are in mind. Indeed this confusion is rather widespread and it is evident that little can be accomplished in respect to a changed curriculum until these objectives have been considerably clarified. This question of objectives is being given a great deal of attention by Dean Doherty's Committee and the report of that Committee at Atlanta should be of vital interest to all of us concerned in this particular study.

Much missionary work remains to be done before we may hope to even approach our goal, but sentiment is crystallizing rapidly and I regard the present outlook as hopeful and as distinctly indicating the desirability of a continuation of study and effort to bring about a new dispensation in the field of professional engineering education.

I believe a study of the returns will show rather clearly that many of those institutions now opposed to the plan of a five-year course are essentially those whose faculty contacts with the S. P. E. E. and its findings have been meagre to say the least. In this respect I feel that many are yet unaware of a changing sentiment and have not as yet grasped the full significance of recent trends.

It is further clear that in some cases the report as indicated does not mirror the real faculty sentiment, but rather gives a horse-back judgment of perhaps one man, perhaps the Dean alone. I am confident that several of the returns were never given sufficient faculty study to bring out a real consensus of opinion.

It will be noticed that on the questionnaire all the institutions in Texas, for example, with the exception of the University of Texas, indicate their opposition to the five-year curriculum. It is interesting in this connection to have the following statement which I received from Professor Correll of the University of Texas a few days ago, after a meeting of the Texas Section of S. P. E. E. at Lubbock where the content of the Electrical Engineering curriculum was discussed at length.

"From this discussion I believe the opinion is growing each year that the five-year curriculum must be resorted to in order to give adequate fundamental training in electrical engineering."

I submit that such straws show distinctly a positive trend which needs merely careful fostering to show increasing strength within a very reasonable time.

Doubtless you have also noted a recent address by Past-President Wickenden in which he speaks of "The Second Mile" as a necessity for preparing properly those who may aspire to real leadership in the engineering profession. He does, however, still maintain that for the average man a four-year

program should be sufficient, and favors a common program for both types with the exception of the last year. I cannot agree with the latter suggestion, although that idea seems to be in the mind of several other well known leaders. Such a program seems far too difficult to set up adequately and I personally prefer a differentiated training with all the difficult problems which such a set-up would encounter by reason of the general attitude on the part of nearly all institutions giving engineering training that they must each train for the highest, thus leaving those who should receive an intermediate program quite out in the cold with nowhere to go.

I feel very frankly that there are too many institutions attempting the impossible in the way of engineering training at present, while recognizing the almost insuperable difficulties in the way of getting any of them to be content with a more modest coverage.

It is rather evident that much as we might desire it there will be small possibility of getting real action along the new lines as early as 1940. I believe that the activities of the ECPD about to be inaugurated in connection with some accredited scheme may help to clarify some of the difficult points.

The question of degree practice leads to no really definite end as revealed in the questionnaire, but here again I feel that much may be hoped for following the Committee Report at Atlanta which Dean Leland is to make.

The questionnaire was worth while. The question should be strongly pushed. Many persons may receive quite a surprise when the snow-ball really gets under way as I feel it well may shortly.

Upon motion, passed unanimously, report was received and the committee discharged.

After considerable discussion: which indicated the following possibilities; first, a straight four year engineering course for the high grade students; second, a five year course required by the lower grade students because of inferior mental caliber; third, a straight five year course required because of the addition by the powers of the administration of courses in economics, humanities, etc.; fourth, the increase of engineering subjects as well as economics, humanities, etc., requiring five years for all students: it was moved and carried that a committee of three be appointed to continue the observation of experiments and practices along the above lines in our engineering schools and to make report again at our next meeting. Committee: Dean Van Leer, Dean Rodman, Dean Lassalle.

It was moved and carried that the matter of time and place of the next meeting be referred to the executive committee.

Professor D. C. Jackson, Jr., Chairman of the Kansas-Nebraska Section, addressed the Conference in a few words of encouragement and good wishes of the Kansas-Nebraska Section for the Southeastern Section and urged the importance of continuing and encouraged the work of the Section.

FLOYD FIELD,
Chairman

DIVISIONS

The following officers were elected for the coming year by the members of the **Civil Engineering Division**:

Name	Address	Term Expires
Fred L. Plummer (*Chairman*)	Case School of Applied Science, Cleveland, Ohio	1936
H. C. Bird (*Secretary*)	Duke Univ., Durham, N. C.	1938
Frank Kerekes	Iowa State College, Ames, Iowa	1936
L. E. Grinter	Texas A. & M. College, College Station, Texas	1937
K. C. Reynolds	Mass. Inst Tech., Cambridge, Mass.	1937
H. E. Babbitt	Univ. Illinois, Urbana, Ill.	1938

The Executive Committee of the **Machine Design Division** for 1935–36 consists of:

Name	Address	Term Expires
F. L. Eidmann (*Chairman*)	Columbia Univ., New York City	1936
V. M. Faires	Texas A. & M. College, College Station, Texas	1936
C. W. Hamm	Univ. of Illinois, Urbana, Ill.	1936

The organization of the executive committee of the **Division of Mechanics** is:

Name	Address	Term Expires
A. E. Norton (*Chairman*)	Harvard Engineering School, Cambridge, Mass.	1936
F. B. Seely	Univ. Illinois, Urbana, Ill.	1936
Z. R. Bliss (*Secretary*)	Brown Univ., Providence, R. I.	1937
W. R. Cornell	Cornell Univ., Ithaca, N. Y.	1937
H. L. Mason	Columbia Univ., New York City	1938
F. T. Mavis	Univ. of Iowa, Iowa City, Ia.	1938
W. J. Cox	Yale Univ., New Haven, Conn.	1939
H. J. Gilkey	Iowa State College, Ames, Iowa	1939

COLLEGE NOTES

The largest total enrollment and the largest freshman class since 1930 are registered at **Case School of Applied Science,** Cleveland, this fall. There are 217 freshman, 175 sophomores, 131 juniors, and 123 seniors, bringing the total to 646. In addition there are 28 men taking the post-graduate courses. The 1934 enrollment was 577. There is also a 20 percent increase in the enrollment of the evening division.

Professor William R. Veazey, head of the department of chemical engineering, one of the most prominent and loved members of the Case faculty, has resigned in order to take a position on the executive staff of the Dow Chemical Company, located at Midland, Michigan. Dr. Veazey has been a member of the Case faculty since 1907. Since the days of the war, Dr. Veazey has been actively engaged in the interests of the Dow Chemical Company, undertaking the problem of producing commercially metal magnesium from byproducts of other processes. Since 1927, he has been a director of this company. At Case, his department has prospered greatly under his leadership. In addition, he has been chairman of the graduate division and of the committee on Business Options, recently added to the Case curriculum.

University of Illinois.—Beginning with September, 1935, the four-year curriculum in Metallurgical Engineering goes into full effect. This curriculum was opened to freshmen and sophomores in 1933, and to juniors in 1934. To care for the advanced courses, H. B. Wilder (M.A., Ohio State, 1928; D.Sc., Harvard, 1933) has been appointed Assistant Professor of Metallurgical Engineering. Dr. Wilder has taught at Mt. Union, Ohio State, Case and Harvard, and has a splendid background of industrial experience. For the last two years he has been with the research laboratory of the American Steel & Wire Co. at Cleveland.

A new laboratory for metallurgical work will be completed within the coming year, a $50,000 appropriation having been allowed by the legislature—the only building project approved. This laboratory will be built as a wing to the present Mining Laboratory, and will be about 100 feet by 42 feet, two stories high.

University of Maine.—Hugh D. Chase (S.B. Massachusetts Institute of Technology 1931; S. M. 1932) formerly Instructor of Civil Engineering has been appointed Assistant Professor of Civil Engineering. John G. L. Caulfield (B.S. Maine 1924; M.S. 1926)

formerly Instructor of Pulp and Paper Technology has been appointed Assistant Professor of Pulp and Paper Technology. Stanley Young replaces Neil Calderwood as assistant in freshman personnel work. Mr. Young will also work this year for the M.S. degree in Mechanical Engineering.

L. C. Jenness, Associate Professor of Chemistry, has been appointed Acting Head of the Department of Chemistry and Chemical Engineering for 1935–36. Professor Jenness was located during the summer with the experimental plant of the Intermetal Corporation at Newark, N. J. in connection with the commercialization of some research projects carried out in part at the University of Maine.

C. A. Brautlecht expects to devote considerable time on research to determine the economic desirability of large scale production of starch from Maine potatoes. In that connection he has made several visits to starch plants in the State and some starch and alcohol plants in the middle west during the summer.

Dean Paul Cloke spent some time during the summer studying power distribution at the plants of the Union Water Power Company and Central Maine Power Company, which develop power form the Androscoggin River, supplying the industries of Auburn and Lewiston. He was the guest of Mr. Paul Bean, Chief Engineer of the Union Water Power Company.

Professor Weston S. Evans, of the Department of Civil Engineering, made an extensive study of the grades received by Sophomore students in the Comprehensive Examinations in Mathematics, Physics and Chemistry. Professor Arthur S. Hill, of the Department of Electrical Engineering, continued his research work for the Reliance Electric and Engineering Company of Cleveland, Ohio. Professor I. H. Prageman, of the Department of Mechanical Engineering, made an extensive tour of the western part of the country during the summer. Among places visited were the Bonneville Dam on the Columbia River and the Boulder Dam on the Colorado River.

The Maine Technology Experiment Station issued during the summer Volume II of the Bulletin, "Survey of Road Materials and Glacial Geology of Maine" by Professor H. Walter Leavitt of the Department of Civil Engineering, University of Maine, and Edward H. Perkins, Professor of Geology at Colby College. Volume I of this bulletin was published last year. The Maine Technology Experiment Station expects to publish soon a bulletin on highway safety, An Investigation of the Effectiveness of Stop Signs and Stated Speed Slow Signs at Highway Intersections Having Obstructions of View" by Rufus Guy Jasper. Several alterations made in Aubert Hall during the summer improved working fa-

cilities appreciably. In addition to an improved pulp and paper laboratory, some of the general chemistry laboratories were increased in capacity and space in the basement was made suitable for work of an engineering operation nature.

Northeastern University.—*A. New Laboratory Facilities.* 1. During the summer the University has considerably increased its laboratory areas and equipment. A new chemical engineering laboratory, equipped for experimentation in the unit processes on a semi-plant scale, has been installed under the supervision of Professor Chester P. Baker. The storeroom and workshop of this laboratory have been equipped with materials and tools for the construction of apparatus for thesis work.

The distillation equipment consists of a 24″ steam-jacketed kettle connected to an 8″ fractionating column of 15 plates, a condenser, and two enclosed receiving tanks. The equipment is designed to operate under vacuum or pressure, while the fractionating column is so constructed that it may be used as an absorption tower.

For the study of evaporation and drying there are three units available: a Carrier Processing cabinet, a vacuum shelfdryer, and steam drying rolls for the drying of pastry materials. Filtration will be studied with the aid of a Sweetland filter press, an Oliver pressure filter, a rotary vacuum filter, and a plate and frame filter press.

The crushing and grinding equipment available is a jaw crusher, a Sturtevant sample grinder, a Simpson rotex sifter, and a Ro-Tap testing sieve shaker. A Pneumatic Air Classifier will aid in the separation of extremely fine particles. Mixing operations will be carried out in a Simpson intensive mixer for solids and pastry materials, or in the steam-jacketed mixing kettles for the liquids.

Flow of fluids measurements will be made with the common measuring devices that are used for this purpose, such as the Venturi meter, the Pitot tube, and the Standard orifice. A Fletcher laboratory centrifugal which is designed to serve as an extractor, separator, or a centrifuge, will aid the instructional work in this laboratory.

2. An advanced physics laboratory which will be given over especially to research work in electrophysics, spectroscopy, and photometry has been equipped under the direction of Dr. Carl F. Muckenhoupt, Head of the Physics Department. Apparatus installed during the summer and ready for use this fall includes: A Lummer-Brodhun eleven-foot bar photometer complete with all auxiliaries, Brownian movement apparatus, telemicroscope, Zeiss microscope with optical equipment, oil drop apparatus, tilting elec-

troscope, General Radio impedance bridge, and an electron oscillograph, together with necessary instruments, tubes, and other auxiliary equipment. The new laboratory includes a shop for the construction of experimental and demonstration apparatus.

3. A new Cine Kodak Model K camera completely equipped together with a 16 mm. motion picture projector have been added to the equipment of the Industrial Engineering Department to permit experimentation in micro-motion study. Laboratory work will be conducted in connection with the course in Methods Engineering offered by Professor Knowles.

B. The Faculty Committee on Instruction has approved the following changes in engineering curricula to become effective in September 1935. The course in General Inorganic Chemistry given to all engineering freshmen will be offered three hours a week throughout the entire first year. The course in Elements of Surveying, formerly required of all engineering freshmen in the first semester, will no longer be offered. A re-arrangement of engineering curricula permits the inclusion of additional courses in applied science and affiliated engineering subjects for all engineering students, without reducing the liberal content of the programs of instruction.

C. Dean Carl S. Ell, who last spring completed twenty-five years of service at Northeastern University, was awarded the honorary degree of Doctor of Science by DePauw University at the commencement exercises in June. Dean Ell was graduated from DePauw with the degree of Bachelor of Arts in 1909, and also holds the degrees of S.B. and M.S. from the Massachusetts Institute of Technology and the degree of Ed.M. from Harvard University.

D. New appointments to the faculty of the Day Division this year include that of Albyn Mackintosh, Instructor in Civil Engineering; Stanley Miroyiannis, Consultant in Biology; Allen D. Bliss, Instructor in Chemistry; and Langley U. Morang, Coach of Cross Country Track. Mr. Mackintosh is a graduate of Colorado College from which he holds the degrees of S.B. (magna cum laude) and M.S., and where he has previously taught. Dr. Miroyiannis will assist in the development of a biological laboratory and of courses in botany and zoology. For the past eight years Dr. Bliss has been assistant editor of the Journal of the American Chemical Society. He is a graduate of Middlebury College and of Harvard University.

BOOK REVIEWS

Practical Mechanics of Motion. J. F. Mangold McGraw-Hill Book Co.

This book should suit the needs of many schools that carry engineering in their curriculum. The subject covered by this book "Kinematics and Kinetics," is usually mistreated as to the time allotted. The eight chapters could be covered in the very restricted course of thirty semester hours, although the usual forty-five semester hour course would be more adequate. The absence of calculus should be an advantage for the specific purpose for which the book was written, "suitable for study in trade and evening schools . . . and for use by the technical man seeking to review the subject." The absence of calculus permits the review of the subject by a great number of technical men that would be otherwise quite hampered. The study of velocity and accelerations is handled by the use of algebra, trig. and graphs, while the study involving moments of inertia involve the usual methods of the definition of calculus without giving it a name, *i.e.*, the use of the process of summation of the differential product of the mass and the square of the radius of gyration.

Since the book is rather short, it follows that the use of this book should be accompanied by competent instruction. The many illustrative problems are very well organized and graded. All material is set forth in a very straightforward manner and seems to contain much less "black magic" than other more lengthy texts covering the same subject.

Internal Combustion Engines. V. L. Maleev, M.E., Dr. A.M.

This book defines the terms used in quite a concise yet complete manner. The use of "variable specific heats" as functions of absolute temperature is not overemphasized. The review of "Thermodynamics" is well presented. The introduction of the variation of the exponent upon the press.-vol. diagram as well as general methods of finding the exponent are included.

The omission of obsolete cycles will meet with adverse comment from the older school of teachers, however it would be impossible to cover to-days ground if the author is compelled to cover all the Historical details.

The author is trending away from the empirical "rule of thumb" which has always dominated at the start. The author further shows that he has applied no little amount of sense in his statement about the present use of the Higher Heating Value.

The book is very well adapted to a course that is preceded by the usual undergraduate course in thermodynamics.

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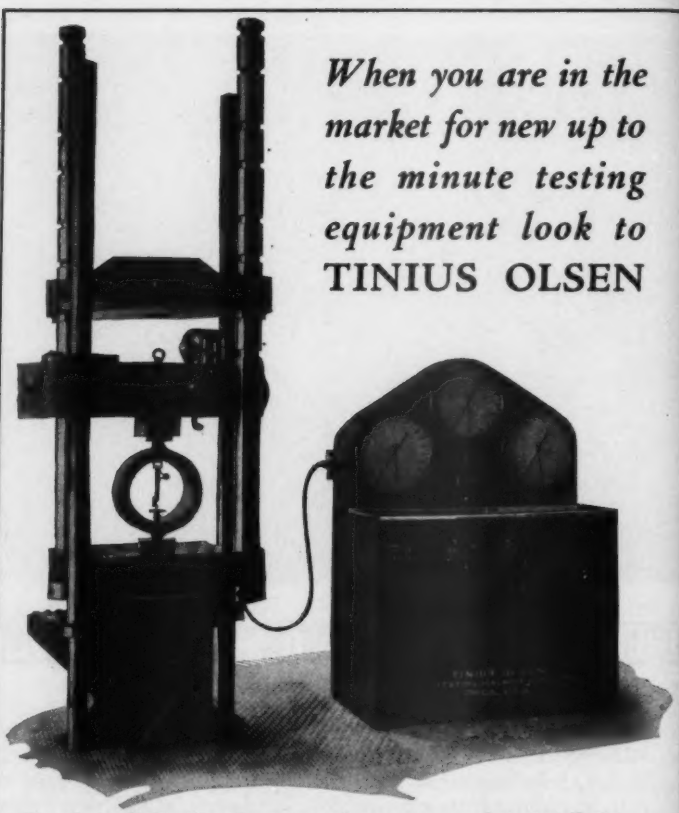

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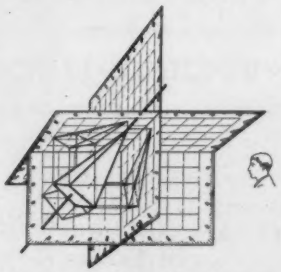

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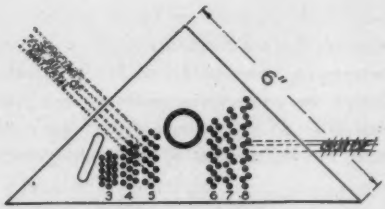

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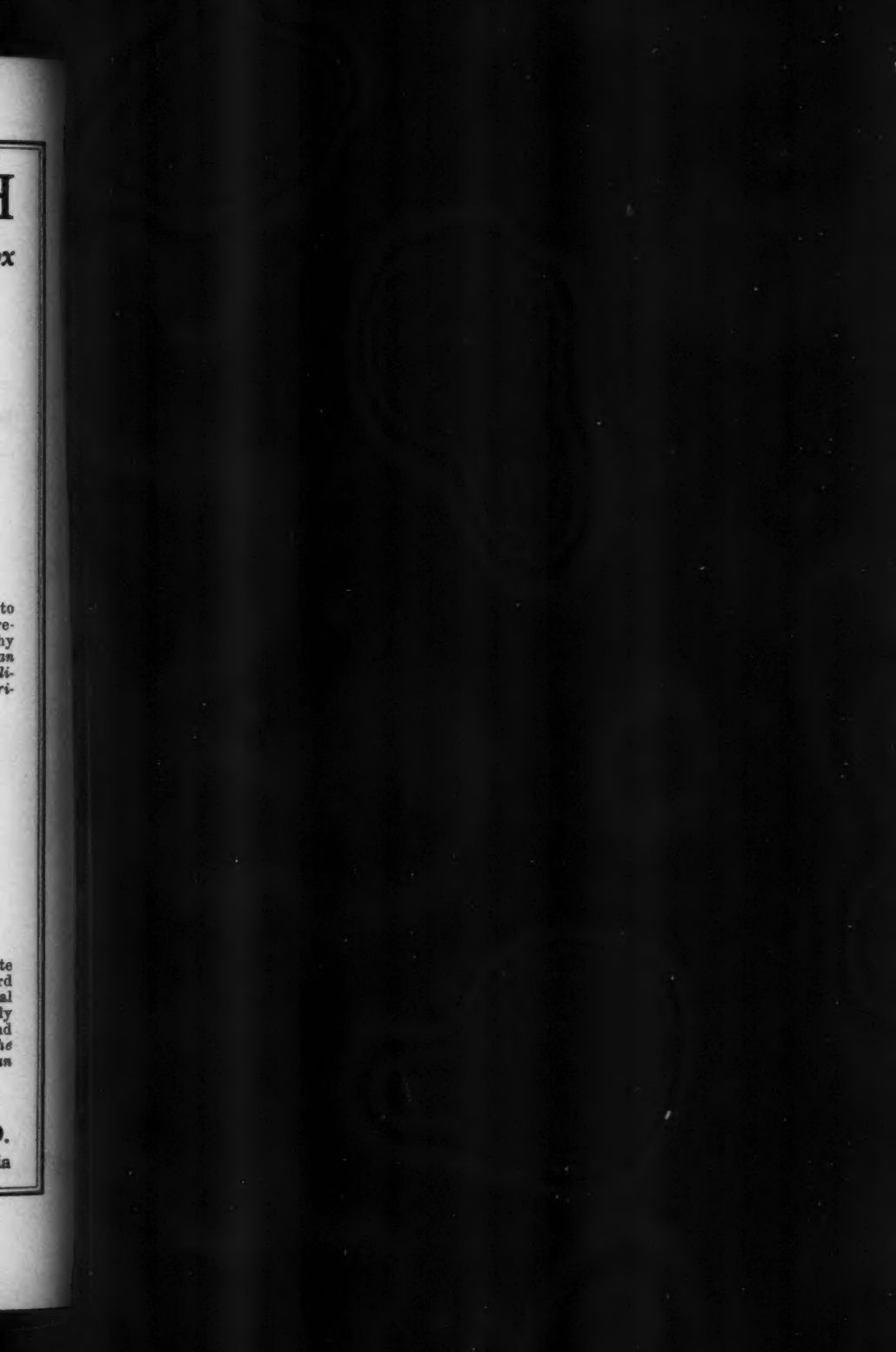

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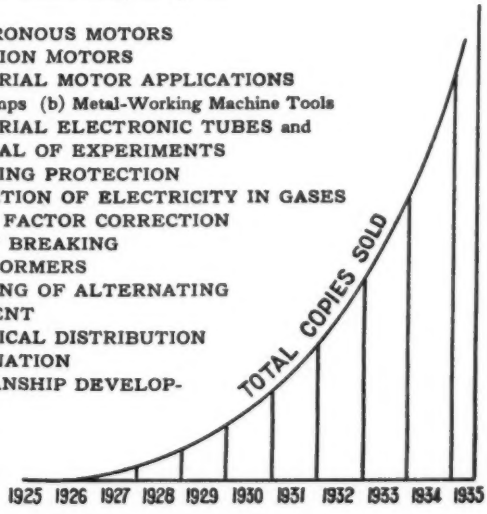

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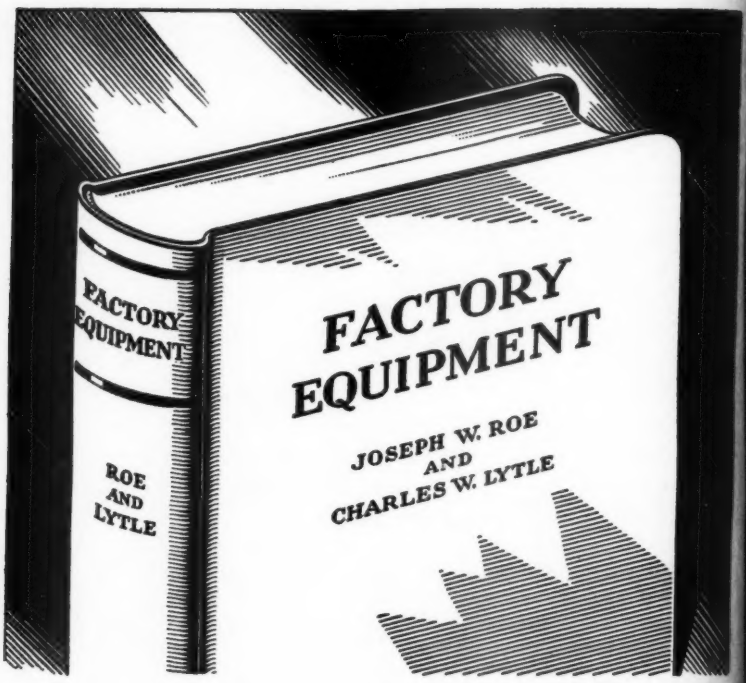

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